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The Sol of New Orleans II
The University of New Orleans's solar powered car

Appendix A

Abbreviations

BCF	Billion Cubic Feet
BTU	British Thermal Unit
DNR	Louisiana Department of Natural Resources
DOE	United States Department of Energy
DOI	United States Department of the Interior
EIA	Energy Information Administration, DOE
FOB	Free on Board
KWH	Kilowatt-hours
MBBLS	Thousand Barrels
MCF	Thousand Cubic Feet
MMS	Minerals Management Service, DOI
MST	Thousand Short Tons
NGC	Natural Gas Clearinghouse
OCS	Outer Continental Shelf
OPEC	Organization of Petroleum Exporting Countries
RAC	Refinery Acquisition Costs
SLS	South Louisiana Sweet Crude Oil
SPR	Strategic Petroleum Reserve
TBTU	Trillion BTU
TCF	Trillion Cubic Feet

State Abbreviations Used in the Louisiana Energy Facts Annual

AL	Alabama	MS	Mississippi
AK	Alaska	ND	North Dakota
CA	California	NM	New Mexico
CO	Colorado	OK	Oklahoma
IL	Illinois	TX	Texas
KS	Kansas	UT	Utah
LA	Louisiana	WY	Wyoming
MI	Michigan		

Appendix B

Data Sources*

1. EMPLOYMENT AND TOTAL WAGES PAID BY EMPLOYERS SUBJECT TO LOUISIANA EMPLOYMENT SECURITY LAW, Baton Rouge, LA: Louisiana Department of Labor, Office of Employment Security, Research and Statistics Unit.
2. MONTHLY ENERGY REVIEW and ANNUAL ENERGY REVIEW, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.
3. NATURAL GAS MONTHLY and NATURAL GAS ANNUAL, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.
4. Baker Hughes from OIL & GAS JOURNAL, Tulsa, OK: Penn Well Publishing Co.
5. October 2002 to Present, NATURAL GAS WEEK, Washington, D.C.: Energy Intelligence Group. Prior, SURVEY OF DOMESTIC SPOT MARKET PRICES, Houston, TX: Dynegy Inc. (Formerly Natural Gas Clearinghouse).
6. PETROLEUM MARKETING MONTHLY and PETROLEUM MARKETING ANNUAL, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.
7. PETROLEUM SUPPLY MONTHLY and PETROLEUM SUPPLY ANNUAL, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.
8. SEVERANCE TAX, Baton Rouge, LA: Louisiana Department of Revenue and Taxation, Severance Tax Section.
9. U.S. CRUDE OIL, NATURAL GAS and NATURAL GAS LIQUIDS RESERVES, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.
10. THE WALL STREET JOURNAL, Gulf Coast Edition, Beaumont, TX: Dow Jones and Company.
11. STATE ENERGY DATA REPORT, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.
12. FEDERAL OFFSHORE STATISTICS, Washington, D.C.: U.S. Department of the Interior, Minerals Management Service.
13. MINERAL REVENUE, Washington, D.C.: U.S. Department of the Interior, Minerals Management Service, Royalty Management Program.
14. ELECTRIC POWER MONTHLY, Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

* Unless otherwise specified, data is from the Louisiana Department of Natural Resources.

Appendix C

Glossary

Bonus. A cash payment by the lessee for the execution of a lease. A lease is a contract that gives a lessee the right: (a) to search for minerals, (b) to develop the surface for extraction, and (c) to produce minerals within the area covered by the contract.

Casinghead Gas. All natural gas released from oil during the production of oil from underground reservoirs.

City-Gate. A point or measuring station at which a gas distribution company receives gas from a pipeline company or transmission system.

Commercial Consumption. Gas used by non-manufacturing organizations such as hotels, restaurants, retail stores, laundries, and other service enterprises. This also includes gas used by local, state, and federal agencies engaged in non-manufacturing activities.

Condensate. (See Lease Condensate).

Crude Oil. A mixture of hydrocarbons that existed in the liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities.

CRUDE OIL PRICES

Domestic Wellhead. The average price at which all domestic crude oil is first purchased.

Imports FOB. The price actually charged at the producing country's port of loading. It is the responsibility of the buyer to arrange for transportation and insurance.

Imports Landed. The dollar per barrel price of crude oil at the port of discharge. It includes crude oil landed in the U.S. and U.S. company-owned refineries in the Caribbean, but excludes crude oil from countries that export only small amounts to the United States. The landed price does not include charges incurred at the port of discharge.

Imports OPEC FOB. The average price actually charged by OPEC at their country's port of loading. This price does not include transportation or insurance.

OCS Gulf. The average price at which all offshore, Outer Continental Shelf, Central Gulf region crude oil is first purchased as reported by the U.S. Department of Energy, Energy Information Administration.

Refinery Acquisition Costs (RAC). The average price paid by refiners in the U.S. for crude oil booked into their refineries in accordance with accounting procedures generally accepted and consistently and historically applied by the refiners.

a) **Domestic.** The average price of crude oil produced in the United States or from the Outer Continental Shelf of the U.S.

b) **Imports.** The average price of any crude oil not reported as domestic.

Refinery Posted. The average price from a survey of selected refiners' postings for South Louisiana Sweet (SLS) crude, which is effective at the middle and at the end of the month.

Severance Tax. The average wellhead price calculated from oil severance taxes paid to the Louisiana Department of Revenue and Taxation.

Spot Market. The spot market crude oil price is the average of daily South Louisiana Sweet (SLS) crude price futures traded in the month and usually includes transportation from the producing field to the St. James, Louisiana terminal.

State. The average price at which all Louisiana crude oil, excluding Louisiana OCS, is first purchased as reported in a survey by the U.S. Department of Energy, Energy Information Administration.

State Royalty. The average wellhead price from its royalty share of oil produced in state lands or water bottoms. The price is calculated by the ratio of received oil royalty gross revenue divided by royalty volume share reported to the Louisiana Department of Natural Resources.

Developmental Well. Wells drilled within the proved area of an oil or gas reservoir to the depth of a stratigraphic horizon known to be productive.

Dry Gas. (See Natural Gas, "Dry").

Dry Hole. An exploratory or developmental well found to be incapable of producing either oil or gas in sufficient quantities to justify completion as an oil or gas well.

Electric Utility Consumption. Gas used as fuel in electric utility plants.

Exploratory Well. A well drilled to find and produce oil or gas in an unproved area, to find a new reservoir in an old field, or to extend the limits of a known oil or gas reservoir.

Exports. Crude oil or natural gas delivered out of the Continental United States and Alaska to foreign countries.

Extraction Loss. The reduction in volume of natural gas resulting from the removal of natural gas liquid constituents at natural gas processing plants.

Federal Offshore or Federal OCS. (See Louisiana OCS)

FOB Price (Free on board). The price actually charged at the producing country's port of loading. The reported price includes deductions for any rebates and discounts or additions of premiums where applicable and should be the actual price paid with no adjustment for credit terms.

Gate. (See City-Gate)

Gross Revenue. Amount of money received from a purchaser, including charges for field gathering, transportation from wellhead to purchaser receiving terminal, and state production severance tax.

Gross Withdrawals. (See Natural Gas, Gross Withdrawals)

Imports. Crude oil or natural gas received in the Continental United States, Alaska, and Hawaii from foreign countries.

Industrial Consumption. Natural gas used by manufacturing and mining establishments for heat, power, and chemical feedstock.

Lease Condensate. A mixture consisting primarily of pentane and heavier hydrocarbons that is recovered as a liquid from natural gas in lease or field separation facilities, exclusive of products recovered at natural gas processing plants or facilities.

Lease Separator. A facility installed at the surface for the purpose of: (a) separating gases from produced crude oil and water at the temperature and pressure conditions of the separator, and/or (b) separating gases from that portion of the produced natural gas stream which liquefies at the temperature and pressure conditions of the separator.

Louisiana OCS. Submerged lands under federal regulatory jurisdiction that comprise the Continental Margin or Outer Continental Shelf adjacent to Louisiana and seaward of the Louisiana Offshore region.

Louisiana Offshore. A 3-mile strip of submerged lands under state regulatory jurisdiction located between the State coast line and the OCS region.

Louisiana Onshore. Region defined by the State boundary and the coast line.

Major Pipeline Company. A company whose combined sales for resale, and gas transported interstate or stored for a fee, exceeded 50 million thousand cubic feet in the previous year.

Marketed Production. (See Natural Gas, Marketed Production)

Natural Gas. A mixture of hydrocarbon compounds and small quantities of various non-hydrocarbons existing in the gaseous phase or in solution with crude oil in natural underground reservoirs at reservoir conditions. The principal hydrocarbons usually contained in the mixture are methane, ethane, propane, butanes and pentanes. Typical non-hydrocarbon gases that may be present in reservoir natural gas are carbon dioxide, helium, hydrogen sulfide and nitrogen. Under reservoir conditions, natural gas and the liquefiable portions occur either in a single gaseous phase in the reservoir or in solution with crude oil, and are not distinguishable at the time as separated substances.

Natural Gas, "Dry". The actual or calculated volume of natural gas which remains after: (a) the liquefiable hydrocarbon portion has been removed from the gas stream, and (b) any volumes of non-hydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable.

Natural Gas, Gross Withdrawals. Full well-stream volume, including all natural gas plant liquids and all non-hydrocarbon gases, but excluding lease condensate.

Natural Gas Liquids. Lease condensate plus natural gas plant liquids.

Natural Gas, Marketed Production. Gross withdrawals less gas used for repressurizing, quantities vented and flared, and non-hydrocarbon gases removed in treating or processing operations. It includes all quantities of gas used in field and processing operations.

Natural Gas, OCS Gas. OCS gas volume is as reported. Most is "dry" gas, though some is "wet" gas.

Natural Gas Plant Liquids. Those hydrocarbons remaining in a natural gas stream after field separation and later separated and recovered at a natural gas processing plant or cycling plant through the processes of absorption, adsorption, condensation, fractionation or other methods. Generally such liquids consist of propane and heavier hydrocarbons and are commonly referred to as condensate, natural gasoline, or liquefied petroleum gases. Where hydrocarbon components lighter than propane (e.g., ethane) are recovered as liquids, these components are included with natural gas liquids.

NATURAL GAS PRICES

Henry Hub Settled NYMEX The last trading day price for the month before delivery posted in the New York Mercantile Exchange for natural gas at Henry Hub.

Spot Market The average price of natural gas paid at the regional spot market receipt points or zones as reported by the Energy Intelligence Group's NATURAL GAS WEEK. The data are a volume weighted average and reflect market activity information gathered during the entire month before the publication date, regardless of delivery date. The data are not an arbitrary weighting by production zone, but a true deal-by-deal volume weighting of prices gathered. Data prior to October 2002 were from Dynegy's survey of the domestic natural gas spot market receipt points or zones located in Louisiana. The new and old points or zones are as follows:

NATURAL GAS PIPELINES AND SALES POINTS FOR PRICES

Dynegy

ANR
 Eunice, LA
 COLUMBIA GULF
 Average Louisiana onshore laterals

 LOUISIANA INTRASTATES
 Average of Faustina, LIG, Bridgeline,
 and Monterrey pipelines
 SOUTHERN NATURAL
 South Louisiana
 TENNESSEE GAS
 Vinton, LA
 TEXAS GAS TRANSMISSION
 Zone 1 (North Louisiana)
 GULF SOUTH PIPELINE

Natural Gas Week

ANR
 Patterson, LA
 COLUMBIA GULF TRANSMISSION Co.
 Average of Erath, Rayne, and
 Texaco Henry Plant in Louisiana
 LOUISIANA INTRASTATES
 Average of LIG, Bridgeline, LRC,
 and Acadian pipelines
 SONAT
 Saint Mary Parish, LA
 TENNESSEE GAS
 Average Zone 1 of 500 & 800
 TEXAS GAS TRANSMISSION
 Zone 1 (North Louisiana)
 TRUNKLINE GAS Co.

OCS. The average wellhead price calculated from sales and volumes from Louisiana OCS natural gas as reported by the U.S. Department of Interior, Minerals Management Service.

State Royalty. The average wellhead price calculated from revenue received and volumes reported to the Louisiana Department of Natural Resources.

State Wells. The average price of gas sold at Louisiana wellhead. This price includes: (a) value of natural gas plant liquids subsequently removed from the gas, (b) gathering and compression charges, and (c) State production, severance, and/or similar charges.

Major Pipelines Purchases.

a) **Domestic Producers.** The average price of natural gas produced in the United States or from the Outer Continental Shelf of the U.S.

b) **Foreign Imports.** The average price of any natural gas not reported as domestic.

Wellhead. The wellhead sales price including: (a) value of natural gas plant liquids subsequently removed from the gas, (b) gathering and compression charges, and (c) State production, severance, and/or similar charges.

Natural Gas, Wet After Lease Separation. The volume of natural gas, if any, remaining after: (a) removal of lease condensate in lease and/or field separation facilities, and (b) exclusion of non-hydrocarbon gases where they occur in sufficient quantities to render the gas unmarketable. Also excludes gas returned to formation in pressure maintenance and secondary recovery projects and gas returned to earth from cycling and/or gasoline plants. Natural gas liquids may be recovered from volumes of natural gas, wet after lease separation, at natural gas processing plants.

Organization of Petroleum Exporting Countries (OPEC). Countries that have organized for the purpose of negotiating with oil companies on matters of oil production, prices, and future concession rights. Current members are Algeria, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.

Outer Continental Shelf (OCS). All submerged lands that comprise the Continental Margin adjacent to the U.S. and seaward of the state offshore lands. Production in the OCS is under federal regulatory jurisdiction and ownership.

Processing Plant. A facility designed to recover natural gas liquids from a stream of natural gas which may or may not have passed through lease separators and/or field separation facilities. Another function of natural gas processing plants is to control the quality of the processed natural gas stream.

Proved Reserves of Crude Oil. As of December 31 of the report year, the estimated quantities of all liquids defined as crude oil which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Volumes of crude oil in underground storage are not considered proved reserves.

Proved Reserves of Lease Condensate. The volumes of lease condensate as of December 31 of the report year expected to be recovered in future years in conjunction with the production of proved reserves of natural gas as of December 31 of the report year.

Proved Reserves of Natural Gas. The estimated quantities of natural gas as of December 31 of the report year which analysis of geologic and engineering data demonstrates with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Volumes of natural gas in underground storage are not considered proved reserves.

Proved Reserves of Natural Gas Liquids. The volumes of natural gas liquids (including lease condensate) as of December 31 of the report year, which analysis of geologic and engineering data demonstrates with reasonable certainty to be separable in the future from proved natural gas reserves under existing economic and operating conditions.

Rental. Money paid by the lessee to maintain the lease after the first year if it is not producing. A lease is considered expired when rental is not paid on time on an unproductive lease.

Reservoir. A porous and permeable underground formation containing an individual and separate natural accumulation of producible hydrocarbons (oil and/or gas) which is confined by impermeable rock or water barriers and is characterized by a single natural pressure system. Reservoirs are considered proved if economic producibility is supported by actual production or conclusive formation tests (drill stem or wire line), or if economic producibility is supported by core analysis and/or electric or other log interpretations. The area of a gas or oil reservoir considered proved includes: (a) that portion delineated by drilling and defined by gas-oil and/or gas-water contacts, if any; and (b) the immediately adjoining portions not yet drilled, but which can be reasonably judged as economically productive on the basis of available geological and engineering data.

Residential Consumption. Gas used in private dwellings, including apartments, for heating, cooking, water heating, and other household uses.

Royalty (Including Royalty Override) Interest. Those interests which entitle their owner(s) to a share of the mineral production from a property or to a share of the proceeds from there. These interests do not contain the rights and obligations of operating the property and normally do not bear any of the costs of exploration, development, or operation of the property.

Royalty Override (Or Overriding Royalty). An interest in oil and gas produced at the surface free of any cost of production. It is royalty in addition to the usual landowner's royalty reserved to the lessor. The Layman's Guide to Oil & Gas by Brown & Miller defines overriding royalty as a percentage of all revenue earned by a well and carrying no cost obligation.

State Offshore. (See Louisiana Offshore).

Wet After Lease Separation. (See Natural Gas, Wet After Lease Separation).

Wildcat Well . (See Developmental Well).

Appendix D

Louisiana Gas Volume at 14.73 psia

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Appendix D-1

LOUISIANA STATE GAS PRODUCTION, WET AFTER LEASE SEPARATION

Natural Gas and Casinghead Gas, Excluding OCS

(Thousand Cubic Feet (MCF) at 14.73 psia and 60 degrees Fahrenheit)*

DATE	NORTH	SOUTH	OFFSHORE	TOTAL
1984	389,939,125	1,400,621,534	320,286,543	2,110,847,202
1985	358,032,963	1,274,608,554	255,072,018	1,887,713,536
1986	370,901,958	1,240,893,984	251,033,103	1,862,829,044
1987	363,802,599	1,175,490,485	232,692,536	1,771,985,620
1988	382,100,449	1,192,889,101	218,544,278	1,793,533,828
1989	386,783,455	1,153,294,096	207,381,469	1,747,459,020
1990	398,236,494	1,160,425,829	185,678,416	1,744,340,739
1991	389,623,599	1,139,243,110	152,895,972	1,681,762,681
1992	379,671,005	1,146,893,542	149,933,256	1,676,497,803
1993	360,897,088	1,126,950,007	156,919,403	1,644,766,497
1994	361,146,486	1,048,229,785	158,315,609	1,567,691,880
1995	370,709,558	1,028,500,599	167,742,330	1,566,952,486
1996	425,506,052	1,048,009,685	189,331,696	1,662,847,432
1997	450,873,442	995,341,920	189,565,415	1,635,780,777
1998	446,138,374	979,584,537	183,246,642	1,608,969,552
1999	402,085,989	928,879,872	152,594,840	1,483,560,702
2000	395,829,467	945,899,010	152,705,343	1,494,217,218
2001	397,384,648 ^r	974,037,120 ^r	153,165,161 ^r	1,525,523,333 ^r
2002	359,101,247 ^r	892,263,222 ^r	136,858,689 ^r	1,389,014,853 ^r
2003	350,349,532 ^r	889,219,893 ^r	132,612,609 ^r	1,372,586,386 ^r
January	28,051,514 ^r	72,569,079 ^r	10,253,343 ^r	111,378,941 ^r
February	26,705,522 ^r	69,258,831 ^r	11,151,784 ^r	106,217,696 ^r
March	29,013,346 ^r	75,441,480 ^r	10,930,987 ^r	115,606,610 ^r
April	28,406,565 ^r	74,071,495 ^r	11,308,737 ^r	113,409,047 ^r
May	29,358,804 ^r	76,746,009 ^r	10,974,913 ^r	117,413,550 ^r
June	28,462,383 ^r	74,607,355 ^r	11,390,818 ^r	114,044,651 ^r
July	29,508,945 ^r	77,553,586 ^r	11,510,351 ^r	118,453,348 ^r
August	29,787,081	78,486,568	10,313,053	119,783,999
September	26,303,571	74,646,896	10,316,973	111,263,520
October	27,280,778	81,594,393	10,225,780	119,192,144
November	26,998,821	78,933,345	10,234,209	116,157,946
December	26,854,696	78,673,111	9,819,576	115,762,016
2004 Total	336,732,025	912,582,148	128,430,523	1,378,683,467
January	33,471,064	70,643,591	8,986,512	113,934,231
February	30,972,778	64,549,669	10,261,258	104,508,959
March	35,215,313	71,909,026	10,008,670	117,385,597
April	34,776,867	69,919,191	10,385,559	114,704,728
May	36,261,072	71,748,077	10,135,064	118,394,708
June	35,429,743	68,899,128	10,417,799	114,463,935
July	36,678,179	70,084,134	9,961,541	117,180,113
August	35,240,826	66,221,960	5,326,408	111,424,327
September	44,923,467	36,094,200	4,940,080	86,344,076
October	49,612,891	33,363,512	4,175,999	87,916,482
November	36,698,463 ^e	28,463,485 ^e	5,705,101 ^e	69,337,947 ^e
December	24,831,113 ^e	44,834,803 ^e	7,195,550 ^e	75,371,017 ^e
2005 Total	434,111,776 ^e	696,730,777 ^e	97,499,541 ^e	1,230,966,121 ^e

^e Estimated ^r Revised ^p Preliminary

* See Table 11 corresponding volumes at 15.025 psia and footnote in Appendix B.

Appendix D-2

LOUISIANA STATE GAS PRODUCTION, WET AFTER LEASE SEPARATION

Natural Gas and Casinghead Gas

(Thousand Cubic Feet (MCF) at 14.73 psia and 60 degrees Fahrenheit)*

DATE	ONSHORE	OFFSHORE		TOTAL
		State	Federal OCS ¹²	
1984	1,790,560,659	320,286,543	3,578,740,589	5,689,587,791
1985	1,632,641,518	255,072,018	3,116,884,507	5,004,598,042
1986	1,611,795,941	251,033,103	2,927,832,280	4,790,661,324
1987	1,539,293,084	232,692,536	3,180,107,212	4,952,092,832
1988	1,574,989,550	218,544,278	3,096,881,645	4,890,415,472
1989	1,540,077,551	207,381,469	3,006,576,077	4,754,035,097
1990	1,558,662,324	185,678,416	3,706,324,064	5,450,664,803
1991	1,528,866,709	152,895,972	3,289,968,620	4,971,731,301
1992	1,526,564,547	149,933,256	3,338,101,465	5,014,599,268
1993	1,487,847,094	156,919,403	3,386,808,671	5,031,575,169
1994	1,409,376,270	158,315,609	3,492,406,781	5,060,098,660
1995	1,399,210,157	167,742,330	3,636,068,016	5,203,020,503
1996	1,473,515,737	189,331,696	3,783,483,306	5,446,330,739
1997	1,446,215,363	189,565,415	3,901,964,998	5,537,745,775
1998	1,425,722,911	183,246,642	3,890,978,799	5,499,948,351
1999	1,330,965,862	152,594,840	3,913,456,139	5,397,016,841
2000	1,341,728,477	152,705,343	3,837,150,457	5,331,584,277
2001	1,371,421,768	153,165,161 ^r	3,895,134,261	5,419,721,191
2002	1,251,364,470	136,858,689 ^r	3,527,116,066	4,915,339,224
2003	1,239,569,425	132,612,609 ^r	3,342,004,232	4,714,186,267
January	100,620,593	10,253,343 ^r	262,890,485	373,764,422
February	95,964,353	11,151,784 ^r	248,617,101	355,733,237
March	104,454,826	10,930,987 ^r	269,617,536	385,003,349
April	102,478,060	11,308,737 ^r	261,242,252	375,029,049
May	106,104,813	10,974,913 ^r	265,764,106	382,843,832
June	103,069,738	11,390,818 ^r	246,749,316	361,209,871
July	107,062,531	11,510,351 ^r	261,240,387	379,813,269
August	108,273,649	10,313,053	253,574,985	372,161,687
September	100,950,467	10,316,973	185,737,324	297,004,764
October	108,875,171	10,225,780	205,923,971	325,024,921
November	105,932,166	10,234,209	220,456,358	336,622,733
December	105,527,807	9,819,576	215,626,854	330,974,237
2004 Total	1,249,314,173	128,430,523	2,897,440,676	4,275,185,372
January	104,114,655	8,986,512	224,212,648	337,313,815
February	95,522,447	10,261,258	208,601,351	314,385,056
March	107,124,339	10,008,670	235,136,348	352,269,357
April	104,696,058	10,385,559	227,579,209	342,660,825
May	108,009,149	10,135,064	240,607,058	358,751,271
June	104,328,872	10,417,799	226,261,441	341,008,112
July	106,762,314	9,961,541	207,353,258	317,311,861
August	101,462,786	5,326,408	189,463,032	292,252,226
September	81,017,667	4,940,080	71,330,381	157,288,128
October	82,976,402	4,175,999	82,956,192	169,108,593
November	65,161,948	5,705,101	107,243,147	178,110,296
December	69,665,916	7,195,550	6,985,990 ^p	83,847,416
2005 Total	1,130,842,553	97,499,541	2,027,730,054^p	3,256,072,148^p

e Estimated r Revised p Preliminary

* See Table 12 corresponding volumes at 15.025 psia and footnote in Appendix B.

NOTE: The 2003 Federal OCS production is estimated from the marketed production

Appendix D-3

LOUISIANA MARKETED AND DRY GAS PRODUCTION (Billion Cubic Feet (BCF) at 14.73 psia and 60 degrees Fahrenheit)*

DATE	MARKETED			EXTRACTION	
	State	OCS	Total ³	LOSS ³	DRY ³
1963	3,317 e	559 ¹²	3,876 e	N/A	N/A
1964	3,520 e	616 ¹²	4,136 e	N/A	N/A
1965	3,731 e	639 ¹²	4,370 e	N/A	N/A
1966	4,145 e	956 ¹²	5,101 e	N/A	N/A
1967	4,640 e	1,076 ¹²	5,717 e	115	5,602
1968	5,017 e	1,399 ¹²	6,416 e	140	6,276
1969	5,424	1,804 ¹²	7,228	179	7,049
1970	5,538	2,250 ¹²	7,788	193	7,595
1971	5,474	2,608 ¹²	8,082	195	7,887
1972	5,120	2,853 ¹²	7,973	198	7,775
1973	5,217	3,025 ¹²	8,242	207	8,036
1974	4,438	3,316 ¹²	7,754	194	7,559
1975	3,792	3,299 ¹²	7,091	190	6,901
1976	3,542	3,465 ¹²	7,007	173	6,834
1977	3,604	3,611 ¹²	7,215	166	7,049
1978	3,368	4,108 ¹²	7,476	162	7,315
1979	3,149	4,117 ¹²	7,266	166	7,101
1980	2,966	3,974 ¹²	6,940	142	6,798
1981	2,715	4,065 ¹²	6,780	142	6,638
1982	2,406	3,766 ¹²	6,172	129	6,043
1983	2,190	3,142 ¹²	5,332	124	5,208
1984	2,282	3,543 ¹²	5,825	133	5,693
1985	1,928	3,086 ¹²	5,014	118	4,896
1986	1,997	2,899 ¹²	4,895	116	4,780
1987	1,974	3,148 ¹²	5,123	125	4,998
1988	2,114	3,066 ¹²	5,180	120	5,060
1989	2,102	2,977 ¹²	5,078	121	4,957
1990	1,573	3,669 ¹²	5,242	119	5,123
1991	1,777	3,257 ¹²	5,034	129	4,905
1992	1,649	3,265 ¹²	4,914	133	4,782
1993	1,674	3,317 ¹²	4,991	130	4,861
1994	1,691	3,479 ³	5,170	129	5,041
1995	1,683	3,425 ³	5,108	146	4,962
1996	1,628	3,662 ³	5,290	140	5,150
1997	1,475	3,652 ³	5,127	147	4,980
1998	1,522	3,652 ³	5,174	142	5,032
1999	1,536 ³	3,636 ³	5,172	162	5,011
2000	1,455 ³	3,664 ³	5,119	162	4,957
2001	1,502 ³	3,673 ³	5,175	150	5,025
2002	1,362 ³	3,421 ³	4,783	160	4,623
2003	1,350 ³	3,364 ³	4,714	158	4,556
2004	1,385 ³	3,103 ³	4,488	154	4,334

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* See Table 13 corresponding volumes at 15.025 psia and footnote in Appendix B.

Appendix D-4

UNITED STATES OCS GAS PRODUCTION¹²

Natural Gas and Casinghead Gas

(Thousand Cubic Feet (MCF) at 14.73 psia and 60 degrees Fahrenheit)*

YEAR	LOUISIANA	TEXAS	CALIFORNIA	TOTAL
1958	127,692,849	0	0	127,692,849
1959	207,156,297	0	0	207,156,297
1960	273,034,452	0	0	273,034,452
1961	318,280,097	0	0	318,280,097
1962	451,952,661	0	0	451,952,661
1963	564,352,609	0	0	564,352,609
1964	621,731,441	0	0	621,731,441
1965	645,589,472	0	0	645,589,472
1966	965,387,854	42,059,386	0	1,007,447,240
1967	1,087,262,810	99,952,947	0	1,187,215,756
1968	1,413,467,614	109,910,788	799,685	1,524,178,086
1969	1,822,544,152	127,096,983	4,845,851	1,954,486,985
1970	2,273,147,052	133,300,405	12,229,147	2,418,676,604
1971	2,634,014,045	127,357,909	15,671,479	2,777,043,433
1972	2,881,364,748	147,156,460	10,033,581	3,038,554,789
1973	3,055,628,252	148,673,638	7,286,549	3,211,588,439
1974	3,349,170,882	159,979,402	5,573,642	3,514,723,926
1975	3,332,169,075	122,572,765	3,951,633	3,458,693,473
1976	3,499,865,919	92,582,425	3,475,201	3,595,923,545
1977	3,647,513,694	86,943,285	3,289,963	3,737,746,942
1978	4,149,731,158	231,857,451	3,472,292	4,385,060,901
1979	4,158,521,732	511,590,610	2,866,822	4,672,979,164
1980	4,013,707,456	624,642,529	3,107,023	4,641,457,008
1981	4,106,494,612	730,275,835	12,766,307	4,849,536,754
1982	3,803,740,070	858,020,303	17,750,924	4,679,511,297
1983	3,173,892,371	850,817,216	16,024,292	4,040,733,879
1984	3,578,740,589	931,293,587	27,806,899	4,537,841,075
1985	3,116,884,507	834,926,527	49,164,213	4,000,975,247
1986	2,927,832,280	978,370,557	42,689,021	3,948,891,858
1987	3,180,107,212	1,204,488,343	40,986,158	4,425,581,714
1988	3,096,881,645	1,178,422,567	34,570,638	4,309,874,850
1989	3,006,576,077	1,165,112,959	28,574,912	4,200,263,949
1990	3,706,324,064	1,348,075,368	38,531,764	5,092,931,196
1991	3,289,968,620	1,184,936,500	40,626,577	4,515,531,697
1992	3,338,101,465	1,239,389,554	40,873,660	4,685,644,750
1993	3,386,808,671	1,027,937,761	42,082,090	4,533,389,755
1994	3,492,406,781	1,014,204,140	41,679,064	4,657,017,854
1995	3,636,068,016	908,520,055	36,425,501	4,692,270,850
1996	3,783,483,306	972,873,764	37,822,941	5,024,420,834
1997	3,901,964,998	965,334,787	40,722,084	5,076,996,337
1998	3,890,978,799	867,606,779	26,431,191	4,835,387,697
1999	3,913,456,139	814,124,878	37,261,450	4,992,363,948
2000	3,837,150,457	886,473,041	36,855,271	4,977,690,726
2001	3,895,134,261	916,020,487	40,447,991	5,217,043,720
2002	3,527,116,066	780,102,403	35,248,976	4,665,993,097
2003	3,342,004,232	831,642,886	37,453,422	4,571,576,810
2004	2,897,440,675	857,670,136	37,501,415	4,168,787,952

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* See Table 15 corresponding volumes at 15.025 psia and footnote in Appendix B.

Appendix D-5

UNITED STATES NATURAL GAS AND CASINGHEAD GAS PRODUCTION³ (Billion Cubic Feet (BCF) at 14.73 psia and 60 degrees Fahrenheit)*

DATE	GROSS	WET AFTER LEASE SEPARATION	MARKETED	DRY	GROSS IMPORTS
1984	20,267	18,412	18,304	17,466	843
1985	19,607	17,365	17,270	16,454	950
1986	19,131	16,956	16,859	16,059	750
1987	20,140	17,557	17,433	16,621	993
1988	20,999	18,061	17,918	17,103	1,294
1989	21,074	18,237	18,095	17,311	1,382
1990	21,523	18,744	18,594	17,810	1,532
1991	21,749	18,703	18,532	17,698	1,773
1992	22,132	18,879	18,712	17,840	2,138
1993	22,725	19,209	18,982	18,095	2,350
1994	23,581	19,938	19,710	18,821	2,624
1995	23,743	19,790	19,506	18,598	2,841
1996	24,114	20,084	19,812	18,854	2,937
1997	24,213	20,122	19,865	18,902	2,994
1998	24,108	20,064	19,961	19,024	3,152
1999	23,823	19,915	19,805	18,832	3,586
2000	24,174	20,289	20,198	19,182	3,782
2001	24,501	20,667	20,570	19,616	3,977 ^r
2002	23,941 ^r	20,020 ^r	19,921 ^r	18,964 ^r	4,015
2003	24,056 ^r	20,125 ^r	20,030 ^r	19,068 ^r	3,944 ^r
January	2,075 ^r	1,717 ^r	1,709 ^r	1,627 ^r	373 ^r
February	1,930 ^r	1,595 ^r	1,588 ^r	1,512 ^r	346 ^r
March	2,076 ^r	1,706 ^r	1,698 ^r	1,617 ^r	349 ^r
April	1,979 ^r	1,641 ^r	1,634 ^r	1,555 ^r	325 ^r
May	2,025 ^r	1,664 ^r	1,656 ^r	1,577 ^r	327 ^r
June	1,943 ^r	1,609 ^r	1,601 ^r	1,524 ^r	342 ^r
July	1,995 ^r	1,660 ^r	1,652 ^r	1,573 ^r	375 ^r
August	1,979	1,683	1,675	1,601	360
September	1,883	1,565	1,558	1,489	345
October	1,992	1,646	1,638	1,566	336
November	1,975	1,606	1,598	1,528	369
December	2,050	1,677	1,669	1,596	413
2004 Total	23,902	19,772	19,677	18,765	4,259
January	2,050	1,665	1,656	1,613	403
February	1,871	1,519	1,512	1,464	356
March	2,060	1,672	1,664	1,610	381
April	1,963	1,609	1,601	1,525	329
May	2,004	1,639	1,631	1,559	336
June	1,929	1,600	1,592	1,522	323
July	1,948	1,619	1,610	1,539	351
August	1,967	1,626	1,618	1,546	343
September	1,746	1,448	1,440	1,377	345
October	1,712	1,419	1,412	1,350	362
November					
December					
2005 Total	19,250	15,817	15,736	15,105	3,530

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* See Table 16 corresponding volumes at 15.025 psia and footnote in Appendix B.

Appendix E

Louisiana Energy Topics

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Calumet Refinery 1996

LOUISIANA ELECTRIC POWER GENERATION AND DISTRIBUTION IN LOUISIANA: UPDATE, JUNE 2004

By
Bob Sprehe, Energy Economist

The Technology Assessment Division (TAD) of the Department of Natural Resources (DNR) has updated its compilation of corporate electric power generation and distribution data in the state. This material is available in a publication which includes a listing of cogeneration facilities also. In subsequent reports scheduled for 2004, TAD will address in more detail issues that are arising from the stalled deregulation initiative that followed enactment of the Energy Policy Act of 1992 (EPA92), as well as any subsequent legislation or regulation that may ensue. By the end of June 2004, new energy legislation had stalled in the Congress of the United States. The issues become more complex the longer they remain unaddressed.

It would be an understatement to say that the electric power generation sector of the economy is suffering “convulsions” from the restructuring initiative unleashed by EPA92. Independent power producers (IPPs) and cogeneration of electric power by industrial firms, both for internal process plant use and for the sale of excess power into the market, has grown rapidly since EPA92.

The Importance of Electricity to the Nation...

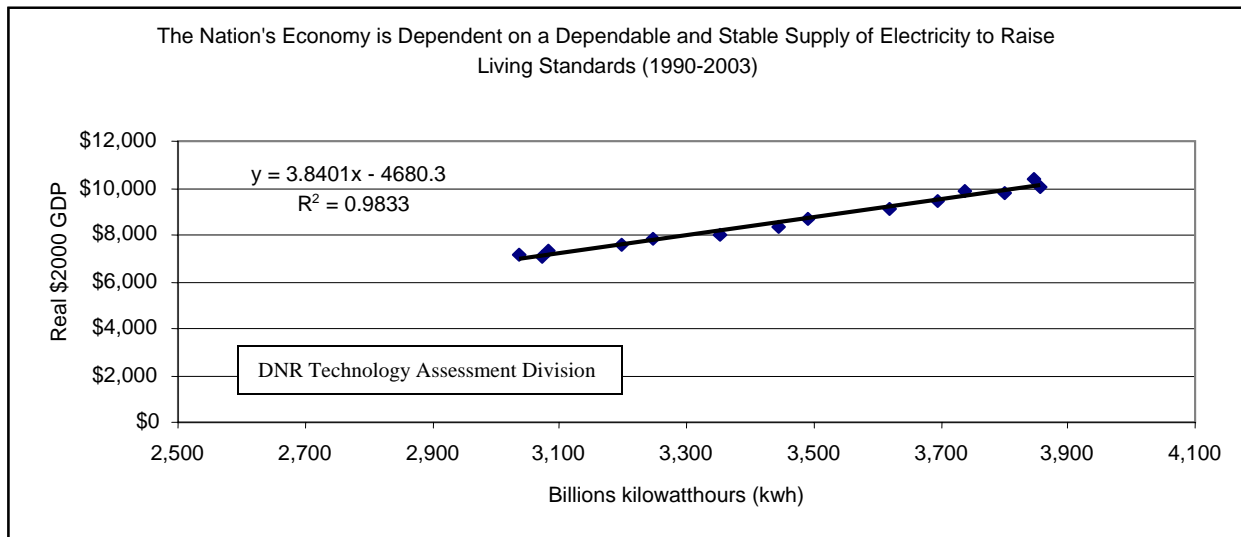


Figure 1

But now the volatility of natural gas prices, and the apparent uncertainty of domestic natural gas supply, has driven many industrial plants, particularly those utilizing natural gas in their processes, out of business here in the U.S. and toward relocation overseas where natural gas supply and labor is less costly. With so much electric power generation dependent on natural gas supply to IPPs and cogen facilities, both in Louisiana and nationally, the dependability of electric power generation becomes a legitimate public policy issue for the consuming public. Planning and financing of coal and nuclear fired power generation, to replace natural gas as a source of power generation, requires many years of preparation.

...and to the State of Louisiana

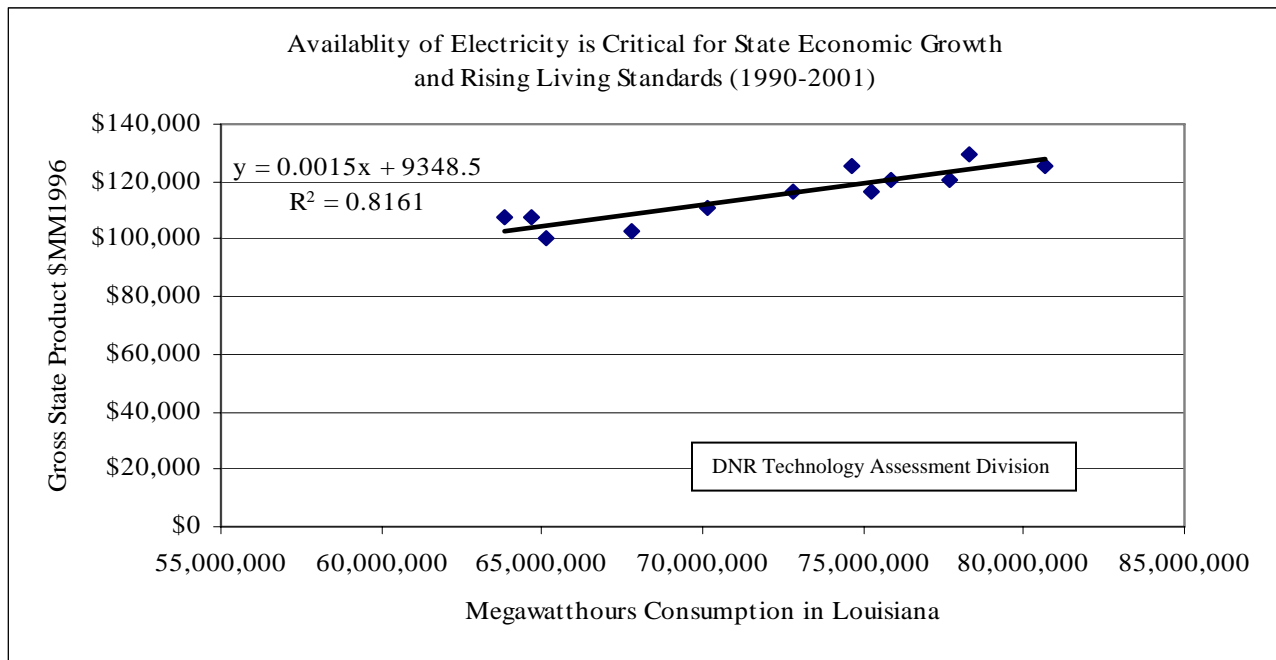


Figure 2

Schematic of Electric Power Generation & Distribution in Louisiana

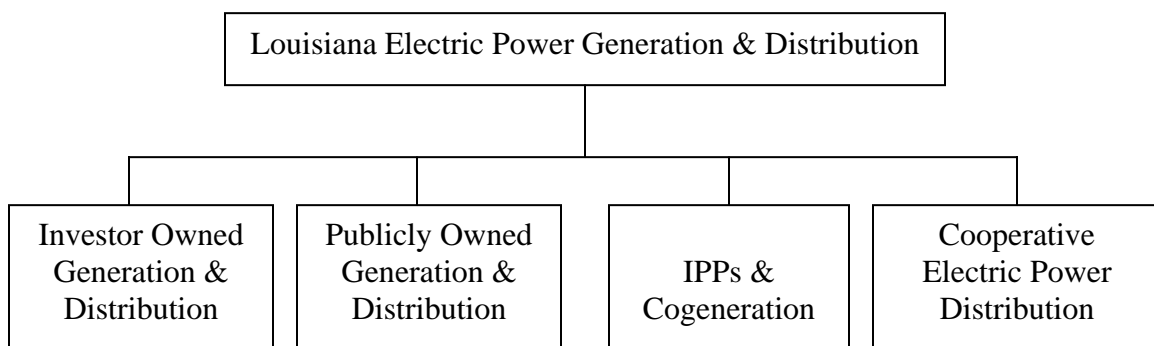


Figure 3

Investor owned utilities continue to dominate the Louisiana market place with nearly 75% of the customers, 85% of power sales, and 55% of the electric power generation facilities.

Table 1
Summary of Market Share between Types of Distribution and Generation Organizations (2002)

Distribution & Generation					Distribution & Generation %			
	Number of Consumers	Revenue (\$000's)	Sales (000 kwh)	Generating Capacity MW	Number of Consumers	Revenue	Sales	Generating Capacity
Investor-Owned	1,598,991	\$4,000,861	67,844,289	14,134.8	75.75%	84.29%	85.60%	55.16%
Cooperative	359,391	\$477,054	7,233,854	0.0	17.03%	10.05%	9.13%	0.00%
Publicly Owned	152,386	\$268,485	4,182,846	822.0	7.22%	5.66%	5.28%	3.21%
IPPs, Cogen	0	0	0	10,667.6	0	0	0	41.63%
2002 Totals	2,110,768	\$4,746,400	79,260,989	25,624.4	100.00%	100.00%	100.00%	100.00%

Source: EIA

Table 2
Summary of the Generating Capacity of Electricity by Fuel Sources

		1993	1997	2002	Annual Growth Rate 1993-2002 %	1993	% Share 1997	2002
	Coal	3,343	3,453	1,723	-7.1	17.00%	16.90%	6.70%
	Petroleum	16	16	16	0.0	10.00%	10.00%	10.00%
	Natural Gas	1,811	1,910	1,735	-0.5	9.20%	9.40%	6.80%
	Dual Fired	9,709	9,689	8,689	-1.2	49.50%	47.50%	33.90%
	Nuclear	2,006	2,011	2,071	0.4	10.20%	9.90%	8.10%
Total Electric Utilities		16,885	17,079	14,233	-1.9	86.00%	83.70%	55.50%
	Coal	8	8	1,730	81.8	0.00%	0.00%	6.70%
	Petroleum	0	6	46	NM	0.00%	0.00%	0.20%
	Natural Gas	1,652	2,285	8,724	20.3	8.40%	11.20%	34.00%
	Other Gases	10	27	62	22.7	0.10%	0.10%	0.20%
	Dual Fired	378	290	451	2.0	1.90%	1.40%	1.80%
	Hydroelectric	182	182	192	0.6	0.90%	0.90%	0.70%
	Other Renewables	487	517	170	-11.0	2.50%	2.50%	0.70%
	Other	21	21	24	1.6	0.10%	0.10%	0.10%
Total IPPs & Combined Heat & Power		2,739	3,337	11,399	17.2	14.00%	16.30%	44.50%
	Coal	3,351	3,461	3,453	0.3	17.10%	17.00%	13.50%
	Petroleum	16	22	62	16.2	0.10%	0.10%	0.20%
	Natural Gas	3,463	4,195	10,458	13.1	17.60%	20.50%	40.80%
	Other Gases	10	27	62	22.7	0.10%	0.10%	0.20%
	Dual Fired	10,087	9,980	9,140	-1.1	51.40%	48.90%	35.70%
	Nuclear	2,006	2,011	2,071	0.4	10.20%	9.90%	8.10%
	Hydroelectric	182	182	192	0.6	0.90%	0.90%	0.70%
	Other Renewables	487	517	170	-11.0	2.50%	2.50%	0.70%
	Other	21	21	24	1.6	0.10%	0.10%	0.10%
Total Electric Industry		19,624	20,416	25,633	3.0	100.00%	100.00%	100.00%

Source: EIA Electric Power Data Base Files

Generation of Electric Power

In the aggregate, 50% of Louisiana's electric power generation relies on natural gas as its fuel source. Nearly 23% comes from coal fired generation; and nearly 18% from nuclear power.

Table 3
Electric Power Generation in Louisiana, 1993-1997-2002 (MWHs)

		1993	1997	2002	Annual Growth Rate 1993-2002 %	1993	% Share 1997	2002
	Coal	19,365,873	20,952,995	12,258,694	-5.0	24.50%	25.30%	12.90%
	Petroleum	1,837,844	645,547	68,460	-30.6	2.30%	0.80%	0.10%
	Natural Gas	23,750,752	26,010,452	25,085,994	0.6	30.10%	31.40%	26.40%
	Other Gases	0	0	203,484	NM	0.00%	0.00%	0.20%
	Nuclear	14,398,103	13,511,008	17,305,328	2.1	18.20%	16.30%	18.20%
Total Electric Utilities		59,352,572	61,120,002	54,921,960	-0.9	75.20%	73.80%	57.80%
	Coal	45,855	54,126	9,792,212	81.5	0.10%	0.10%	10.30%
	Petroleum	1,649,723	1,640,597	1,796,076	0.9	2.10%	2.00%	1.90%
	Natural Gas	12,604,472	14,566,110	22,814,854	6.8	16.00%	17.60%	24.00%
	Other Gases	700,587	1,088,279	1,294,140	7.1	0.90%	1.30%	1.40%
	Hydroelectric	1,231,946	1,035,961	891,441	-3.5	1.60%	1.30%	0.90%
	Other Renewables	2,674,066	3,138,770	2,862,791	0.8	3.40%	3.80%	3.00%
	Other	716,315	177,799	597,490	-2.0	0.90%	0.20%	0.60%
Total IPPs & Combined Heat & Power		19,622,964	21,701,640	40,049,003	8.2	24.80%	26.20%	42.30%
		1993	1997	2002	%	1993	1997	2002
	Coal	19,411,728	21,007,121	22,050,906	1.4	24.60%	25.40%	23.20%
	Petroleum	3,487,567	2,286,144	1,864,536	-6.7	4.40%	2.80%	2.00%
	Natural Gas	36,355,224	40,576,562	47,900,848	3.1	46.00%	49.00%	50.40%
	Other Gases	700,587	1,088,279	1,497,624	8.8	0.90%	1.30%	1.60%
	Nuclear	14,398,103	13,511,008	17,305,328	2.1	18.20%	16.30%	18.20%
	Hydroelectric	1,231,946	1,035,961	891,441	-3.5	1.60%	1.30%	0.90%
	Other Renewables	2,674,066	3,138,770	2,862,791	0.8	3.40%	3.80%	3.00%
	Other	716,315	177,799	597,490	-2.0	0.90%	0.20%	0.60%
Total Electric Industry		78,975,536	82,821,642	94,970,963	2.1	100.00%	100.00%	100.00%

Source: EIA Electric Power Data Base Files

ECONOMICS OF OFFSHORE WIND POWER

by
Bob Sprehe, Energy Economist
and
Bryan Crouch, P.E

Introduction

The December, 2004 Louisiana Energy Topic gave an overview of wind generated electricity and how it relates to Louisiana. It can be downloaded in Adobe PDF format at:

<http://www.dnr.state.la.us/sec/execdiv/tehasmt/newsletters/index.htm>.

This month's edition focuses on the economics of offshore wind generated electricity. A simple economic analysis will be presented for a nominal 50 MW offshore wind farm after a discussion of the key inputs and assumptions. This economic analysis will present data at three different prices of electricity and three different wind classes. It will also present a breakeven price of electricity for each wind class.

The economics of land-based wind power are fairly well established, but much less so for offshore wind power as no offshore wind farms have actually been built in the U.S., although several have been built in Europe. Wind farms are more expensive to build offshore than onshore. The higher cost is mainly due to costs involved with transmitting the power back to land and because it is generally more expensive to build anything over water than land (something in which Louisiana industries are adept).

Inputs and Assumptions

The economics of an offshore wind farm will vary greatly depending on the specifics of a particular wind farm. As such, this analysis is only meant to show a range of possible scenarios and shed some light on the information used in such an analysis. It is based on the assumptions discussed below, and even relatively small changes in these assumptions can lead to very different results.

The cost to install a utility-scale wind farm on land is in the neighborhood of \$1000/kW¹. Estimates for offshore wind farms range from \$1500 to \$2000/kW². The middle price of \$1750/kW was chosen which puts the installation cost at \$84,700,000 for a 48.4 MW wind farm. Operation and maintenance cost for an offshore wind farm should differ little from land wind farms which run about 2%¹ of the original turbine investment. These costs were set at 2% of the installation cost which is more than just the turbine cost, so this figure is somewhat over-estimated. General and administrative costs are an estimate of basic costs needed to run the company that manages the wind farm and were set at 15%. Turbine lifespan was deemed to be 25 years. Land based turbines commonly last 20 years before a major overhaul is needed. Offshore wind turbines are designed to be more rugged due to the harsh marine environment and are subject to less turbulent wind patterns due to the smooth water surface. In reality, offshore wind turbines may last 30 years or more. Finally, a corporate tax rate of 35% was chosen, and the federal 1.8 cents/kWh tax credit was also taken into account. Straight line depreciation was used here for simplicity. In reality, depreciation would be accelerated depending upon the particular company's tax situation and current tax law.

The biggest assumption that must be made is that of energy production from the wind farm. Energy production from a wind farm is completely dependent on how hard and how often the wind blows. Small changes in wind effect large changes in energy output from a wind turbine. The offshore wind regime is still something of an unknown. To a smaller degree, the selection of a particular wind turbine for a given advertised capacity will determine how much power is produced.

A wind farm consisting of 22, 2.2 MW wind turbines was chosen for a total rated capacity of 48.4 MW. The Danish Wind Industry Association website¹ was consulted to provide a power curve for such a turbine and calculate its annual power production. The annual power production was calculated for wind classes 3, 4, and 5 as defined by the National Renewable Energy Laboratory's wind resource map³. Each wind class has a range of values. The average value for each wind class was used. The values were 15.0 mph, 16.3 mph, and 17.4 mph for wind classes 3, 4, and 5 respectively. The energy output is summarized in **Table 1**.

Table 1. Energy Output

Wind Class (mph)	Energy Output per 2.2 MW Turbine (kWh/year)	Total Energy Output (kWh/year)
Class 3 (15.0)	4,925,000	108,350,000
Class 4 (16.3)	5,782,000	127,204,000
Class 5 (17.4)	6,531,000	143,682,000

Source: LA DNR Technology Assessment Division

Variables not taken into account here include: ancillary service costs, renewable energy credits, and renewable portfolio standards. Ancillary service costs are the costs associated with integrating wind power into the grid. These costs are estimated to be negligible when wind is a small fraction of the total electricity supply. Renewable portfolio standards and renewable energy credits do not directly affect the cost of wind power, but would alter the economics by placing a higher value on wind power.

Results

The results show that electricity generation from this particular wind farm could break even at 4.2 cents/kWh in a class 5 wind resource; however, the rate of return only begins to become attractive at an electricity price of 8 cents/kWh in a class 5 wind resource. For comparison, the average price of electricity per kWh to Louisiana customers in 2002 was as follows: overall = \$0.0599, residential = \$0.0710 (range of \$0.0271 - \$0.0994), commercial = \$0.0664, industrial = \$0.0442. Securing capital for rates of return at these low levels would appear be a controlling factor in the viability of such a project. The results of the analysis are shown in **Tables 2 - 4** according to wind class.

Table 2. Class 3 Wind

Annual Figures	Electricity Price (\$/kWh)			
	0.04	0.06	0.08	0.056*
Revenue	\$4,334,000	\$6,501,000	\$8,668,000	\$ 6,067,600
Operating & maintenance expense	1,694,000	1,694,000	1,694,000	1,694,000
Gross profit	2,640,000	4,807,000	6,974,000	4,373,600
General & administrative expense	650,100	975,150	1,300,200	910,140
Depreciation depletion & amortization	3,388,000	3,388,000	3,388,000	3,388,000
Operating profit	-1,398,100	443,850	2,285,800	75,460
Taxes	0	155,348	800,030	
Production tax credit	1,950,300	1,950,300	1,950,300	
Net taxes	0	0	0	
Net after taxes	-1,398,100	443,850	2,285,800	
Cash flow	1,989,900	3,831,850	5,673,800	
Internal rate of return	-3.73%	0.97%	4.43%	

Table 3. Class 4 Wind

Annual Figures	Electricity Price (\$/kWh)			
	0.04	0.06	0.08	0.048*
Revenue	\$5,088,160	\$7,632,240	\$10,176,320	\$6,105,792
Operating & maintenance expense	1,694,000	1,694,000	1,694,000	1,694,000
Gross profit	3,394,160	5,938,240	8,482,320	4,411,792
General & administrative expense	763,224	1,144,836	1,526,448	915,869
Depreciation depletion & amortization	3,388,000	3,388,000	3,388,000	3,388,000
Operating profit	-757,064	1,405,404	3,567,872	107,923
Taxes	0	491,891	1,248,755	
Production tax credit	2,289,672	2,289,672	2,289,672	
Net taxes	0	0	0	
Net after taxes	-757,064	1,405,404	3,567,872	
Cash flow	2,630,936	4,793,404	6,955,872	
Internal rate of return	-1.86%	2.87%	6.52%	

* Break even

Source: LA DNR Technology Assessment Division

Table 4. Class 5 Wind

Annual Figures	Electricity Price (\$/kWh)			
	0.04	0.06	0.08	0.042*
Revenue	\$5747,280	\$8,620,920	\$11,494,560	\$6,034,644
Operating & maintenance expense	1,694,000	1,694,000	1,694,000	1,694,000
Gross profit	4,053,280	6,926,920	9,800,560	4,340,644
General & administrative expense	862,092	1,293,138	1,724,184	905,197
Depreciation depletion & amortization	3,388,000	3,388,000	3,388,000	3,388,000
Operating profit	-196,812	2,245,782	4,688,376	47,447
Taxes	0	786,024	1,640,932	
Production tax credit	2,586,276	2,586,276	2,586,276	
Net taxes	0	0	0	
Net after taxes	-196,812	2,245,782	4,688,376	
Cash flow	3,191,182	5,633,782	6,955,872	
Internal rate of return	-0.46%	4.37%	8.21%	

* Break even

Source: LA DNR Technology Assessment Division

Conclusion

The results of this economic analysis indicate that small changes in any of the variables could make or break a particular project. Such is the current state of wind power in general. The results also indicate that, in the absence of renewable energy credits, a minimum class 5 wind resource is required for an economically viable wind farm in Louisiana with current technology and at current utility rates for electricity. Wind turbine capacity will become less expensive as turbine efficiencies improve, and turbine prices will come down as economies of scale materialize. As these happen, wind farms may become viable in less than class 5 wind resources.

References	Key	
1. Danish Wind Industry Association www.windpower.org	kW	kilowatt or 1,000 watts
	kWh	kilowatt hour
2. National Wind Coordinating Committee www.nationalwind.org	MW	megawatt or 1 million watts
3. National Renewable Energy Laboratory www.nrel.gov/wind/wind_map.html		

ENERGY-EFFICIENT BUILDING DESIGN FOR THE LOUISIANA CAPITOL COMPLEX: OVERVIEW OF THE PROCESS & RESULTS

by
David Y. McGee
Engineer Supervisor

INTRODUCTION

Louisiana recently designed and began construction on buildings to house state government offices. All of the buildings are located in downtown Baton Rouge near the new state capital building and are referred to as the Louisiana Capital Complex. The first three of these new buildings, the LaSalle Building (364,700 sq. ft.), the Claiborne Building (465,000 sq. ft.) and the Galvez Building (340,000 sq. ft.), were chosen by the Louisiana Department of Natural Resources and U.S. Department of Energy for a demonstration project for energy-efficient building techniques. The overall project goal was to construct buildings that would qualify for an Energy Star rating. Qualification required each building's actual energy use to be 30% less than that of an equivalent building constructed to minimal ASHRAE (American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc.) 90.1-1989 standards.

Advanced software tools, including PowerDOE and Building Life-Cycle Costing program (BLCC), were used to model the energy consumption and emissions output of the buildings. Modeling results indicated that a 39% savings in energy consumption could be realized, i.e., in comparison to an equivalent building built to minimal ASHRAE 90.1-1989 standards, by utilizing conventional energy-efficient building technologies. Savings of this magnitude have been realized around the country in a wide range of building types including schools, offices, and commercial facilities.

This report describes the design procedures and software tools that were used, explains how they were implemented, and discusses their predicted results. In addition, some of the actual electricity consumption figures of the three buildings are presented.

THE DESIGN PROCESS AND PREDICTED RESULTS

The project's goal of achieving Energy Star compliance was further constrained by the following conditions:

- Identify the most effective building concepts to support the missions of the owner.
- Create environmentally sensitive strategies for better buildings that are both pragmatic and repeatable in future facilities to serve as demonstration projects.
- Achieve the desired result with a "real world" budget and schedule.

With these conditions in mind, the measures-of-merit used in deciding what technologies to employ were total life-cycle costs, site life-cycle energy use measured at the meter, oxides of sulphur (SO_x) and oxides of nitrogen (NO_x) emissions (associated with acid rain and smog production), and emissions from carbon dioxide (CO₂), a greenhouse gas. Including these as measures-of-merit in the design criteria helps to determine the full impact of a building on its inhabitants and surrounding community.

Table 1 provides typical office building data reported by the Energy Information Agency in 1999 relative to size, function, and Louisiana climate. The annual energy consumption and expenditure data for typical

office building classes reported below provide a baseline for comparison for the three new state buildings. The ranges of values are averaged to provide a mean reference value.

Table 1: Typical Office Bldg. Data for Size, Function and Louisiana Climate (1999)
U.S. Department of Energy, Energy Information Agency
 Electricity Consumption and Expenditure Intensities, 1999 Building Annual

Building Class by Size, Use, Age, Climate, Occupancy, and Ownership	Annual Electricity Consumption					Electricity Expenditures	
	kwhr ¹ / sq. ft.	mwhr ² / worker	Distribution- kwhr / sq. ft.			\$ / sq. ft.	\$ / kwhr
			25th %	Median	75th %	Average	Cost
200,001 to 500,000 sq. ft.	14.7	11.3	5.1	10.0	20.4	0.95	0.064
Office	18.7	07.8	6.0	11.7	17.9	1.30	0.070
1990 to 1999	17.8	14.4	3.7	08.6	21.8	1.24	0.069
>2,000 CDD ³ & <4,000 HDD ⁴	15.0	12.0	3.3	09.8	22.1	1.02	0.068
49 to 60 hrs/ week	12.0	08.2	4.0	07.7	14.7	0.91	0.076
61 to 84 hrs / week	13.9	10.7	6.2	11.6	23.7	1.06	0.076
Federal Government	21.0	12.5	8.3	18.1	42.8	1.28	0.061
State Government	13.9	13.2	6.4	12.9	17.9	0.94	0.068
Average / year	15.9	11.3	5.4	11.3	22.7	\$1.09	\$0.07

1 - Kilowatt hour 2 - Megawatt hour 3 - Cooling Degree Days 4 - Heating Degree Days

Each building was modeled by M. S. Addison and Associates of Tempe, AZ, using PowerDOE. PowerDOE and its predecessor, DOE2.1E, calculated hour-by-hour building energy consumption over an entire year (8,760 hours) using weather data for the specific location. Life-cycle cost analysis was performed using an easy-to-use spreadsheet from the National Institute of Standards and Technology's widely used BLCC program. For more information on PowerDOE and the user-friendly BLCC program visit the DOE-2 Based Building Energy Use and Cost Analysis Software website at <http://www.doe2.com>.

A detailed description of the building being analyzed, including hourly scheduling of occupants, lighting, equipment, thermostat settings and equipment performance characteristics is input into the program. Discount rates were those established by the U.S. Federal Energy Management Program (FEMP) for the current analysis year. Energy prices were based on local utility contracts.

Emissions factors for NO_x, SO_x, and CO₂, expressed as a function of the amount of electricity and natural gas used, were obtained from two sources:

1. The FEMP web site provides information on the EMISS program developed by the National Institute of Standards and Technology:
 (URL: http://www.eere.energy.gov/femp/information/download_blcc.cfm#emiss).
2. The National Resources Defense Council web site provides data on electric utility emissions by the utility company: (URL: <http://www.nrdc.org/air/pollution/benchmarking/default.asp>).

Baseline levels for utility costs, energy use, emissions levels and peak demand were determined by designs that were minimally compliant with AHSRAE 90.1-1989, the national standard energy code at

the time. Design team members identified a variety of alternative design concepts and technologies including: Siting and orientation; envelope materials and insulation levels; fenestration amount and interior shading/light shelf; the glazing's solar/thermal and daylighting properties; ceiling and interior finish colors; high efficiency indoor lighting; occupancy sensor lighting controls; and automatic dimming controls. Because the HVAC systems would be served by an existing central chilled water plant, HVAC system alternatives focused on heat recovery, two-speed vs. variable speed drives, chilled water pumping control, and air-side economizer types.

A challenge associated with energy efficient building design is the interaction that occurs between design alternatives. It is important to demonstrate both the separate performance of individual design alternatives and the collective performance of the group of recommended features; therefore, care must be taken regarding how the computer simulations are run. This project proceeded by modeling one design alternative at a time on top of design alternatives previously accepted. Only the designs that provided good economic and environmental performance were retained, thus "growing" the design package item-by-item. The incremental and cumulative performance of each alternative was reported.

Typical summary results from the PowerDOE simulations for the Galvez building are shown in **Table 2**. Each row of recommended measures incorporates all previous recommended measures. The 25-year life-cycle costs are reported as undiscounted dollars indicating future operations budget impacts.

Table 2: Typical Results – Galvez Building, Louisiana State Capitol Complex, 12/20/00

Only RECOMMENDED measures are shown	Annual Energy, Demand, & Costs				Cumulative Results (% savings)		
	Site Electricity	Peak Demand	Savings %	Annual Utility Cost (\$)	25 Year Life Cycle*	Annual Savings \$	Δ%
Measure Description*	mwhr	kw	%	Cost (\$)	Cost (\$)	\$	Δ%
Min 90.1 Compliance	7,238	2,836	n/a	\$563,089	14,077,225	n/a	Base
0+Reoriented Building	7,125	2,779	-2%	\$554,469	13,861,725	8,620	-2%
1a+Window Setback	7,044	2,744	-3%	\$548,788	13,719,700	14,301	-3%
1b+Precast Skin	6,872	2,670	-6%	\$532,177	13,304,425	30,912	-5%
1c+Light Surface Color	6,836	2,648	-7%	\$529,378	13,234,450	33,711	-6%
1d+East Patio Shading	6,826	2,641	-7%	\$528,663	13,216,575	34,426	-6%
1e+Increased Wall Insulation	6,805	2,627	-7%	\$526,236	13,155,900	36,853	-7%
2a+Increased Roof Insulation	6,795	2,620	-8%	\$525,266	13,131,650	37,823	-7%
2b+Dbl Low-e Bronze Glass	6,566	2,503	-12%	\$505,914	12,647,850	57,175	-10%
3c+Reduced Lighting Density	6,124	2,337	-18%	\$471,737	11,793,425	91,352	-16%
4a+Daylighting Controls	5,355	2,023	-29%	\$412,231	10,305,775	150,858	-27%
4b+Occupancy Sensors	5,108	1,966	-31%	\$396,539	9,913,475	166,550	-30%
4c+Heat Recovery Ventilator	4,777	1,788	-37%	\$371,866	9,296,650	191,223	-34%
5a+VS Drive Pump Control	4,704	1,756	-38%	\$365,942	9,148,550	197,147	-35%
5b+CO2-Controlled Vent Air	4,689	1,755	-38%	\$365,309	9,132,725	197,780	-35%
5c+Central Chiller Plant	4,617	1,722	-39%	\$359,356	8,983,900	203,733	-36%
Electricity kwhr / sq. ft. / year	13.6			\$1.056 / sf	(-5,093,325)		
*assumes 25 year for architectural features, for lighting equip, & for HVAC equip (includes replacement \$ as needed)							

Projected savings were 36% for energy, annual utility cost, and annual emissions, and 39% for peak electrical demand. These significant reductions will yield a 25-year savings of 1.9 million dollars (discounted) or 5.1 million dollars of avoided utility costs. Expected use and consumption for all three buildings is shown in **Table 3**.

Table 3: Summary of Each Building's Projected Electricity Use

SIMULATION PROJECTIONS	AREA LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	HOT WATER	TOTAL	kwhr/sq. ft./year
BUILDING	Kwhr	Kwhr	Kwhr	kwhr	Kwhr	kwhr	kwhr	kwhr	kwhr	year
LASALLE	622,520	1,586,445	55,720	569,309	25,612	206,896	255,543	57285	3,379,330	9.27
CLAIBORNE	1,027,943	2,169,632	21,479	826,620	40589	298,138	252,369	Nat. Gas	4,636,770	9.30
GALVEZ	745,029	1,653,000	30,916	621,947	30,925	204,103	347,480	56,895	3,690,295	9.71

Actual electrical consumption for the three buildings, as reported by the Office of State Buildings, is shown in **Table 4**, and graphically in **Figure 1**.

Table 4: Monthly Electricity Consumption in kwhr

Month	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04	Year Total
Galvez	514,200	538,200	492,600	496,200	465,000	539,400	538,200	523,200	496,200	475,800	411,000	434,400	5,924,400
kwhr/sf	1.51	1.58	1.45	1.46	1.37	1.59	1.58	1.54	1.46	1.40	1.21	1.28	17.42
La Salle	486,868	639,010	486,016	509,281	524,445	650,492	657,806	615,229	590,775	539,749	450,337	460,155	6,610,163
kwhr/sf	1.33	1.75	1.33	1.40	1.44	1.78	1.80	1.69	1.62	1.48	1.23	1.26	18.12
Claiborne	485,016	480,837	461,423	498,472	456,722	503,352	508,014	494,998	545,396	507,031	470,739	489,691	5,901,691
kwhr/sf	0.97	0.96	0.93	1.00	0.92	1.01	1.02	0.99	1.09	1.02	0.94	0.98	11.83

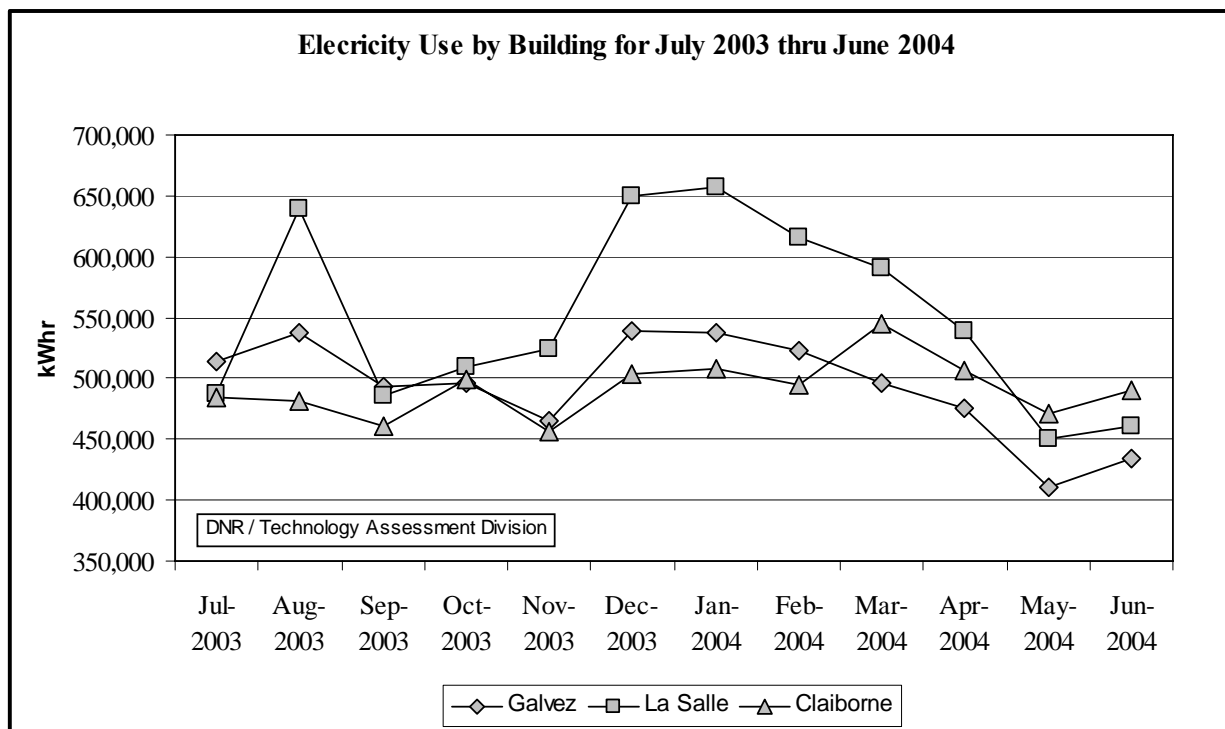
CONCLUSION

When design criteria include environmental measures-of-merit and total building impacts are weighed over the life of the facility, owners and design teams tend to make better choices and tend to be more motivated to identify environmentally superior solutions.

Advances in simulation and economic analysis tools make this extra effort both affordable and reliable. Future software developments will further facilitate the life-cycle environmental building design process and further reduce the cost of identifying "optimal" design solutions.

This project predicted that substantial energy savings and associated emissions reductions could be realized by making use of affordable, conventional energy efficiency building technologies. The actual results, however, have been less than what was predicted. Currently, only the Claiborne Building is performing close to expectations, but the elements needed for success are there; they just need to be tuned to work together as originally intended.

Figure 1: Electrical use by Building for each Month from Office of State Buildings



ANGELLE SPEAKS TO CONGRESS ON ENERGY TOPICS:

Says Louisiana plays a vital role for future supplies

State Department of Natural Resources Secretary Scott Angelle testified before members of the United States Congress April 19, 2005 on energy issues, primarily on the future of alternate energy resources in America and oil and gas exploration and production from the Outer Continental Shelf (OCS). This is the second time this year that Louisiana has been represented before members of the U.S. Energy and Natural Resources Committee where a national energy policy is expected to be formulated.

In January, Secretary Angelle was chosen by Chairman of the U.S. Senate Committee on Energy, Senator Pete Domenici of New Mexico, to provide comments to the Natural Gas Conference that discussed a broad range of proposals on the nation's future energy needs. In his appearance at that time, Secretary Angelle stressed Louisiana's role in supplying energy to the rest of the country through its intricate system of pipelines and infrastructure. Louisiana produces 34 percent of the natural gas supply and almost 30 percent of the crude oil supply for the nation.

During his April 19 address (complete testimony is provided below), Secretary Angelle expressed to committee members that the OCS is probably the single most promising area for the United States to obtain significant new energy supplies. He said, "these new supplies, whether conventional oil and gas, imported oil, imported liquefied natural gas (LNG), wind and ocean energy, or gas hydrates, need the support of coastal states to cooperate and to supply and maintain critical production and support infrastructure." He further commented that it will take the support of the federal government to those producing states to help offset infrastructure costs by sharing some of the offshore production revenues.

Angelle said the state is open to new LNG activity that does not pose environmental hazards and that Louisiana can continue to help America in these critical times. He said, "there is no free lunch and we are now in need of your help to save coastal Louisiana."

In his address Angelle also noted, "It is imperative that we, as a nation, stop reacting to energy situations imposed on us by outside forces, and instead, proactively start shaping our energy future." Joining Secretary Angelle at the hearing was Admiral James Watkins, Chairman of the U.S. Commission on Ocean Policy and Rejane Burton, Director of the Mineral Management Service of the Department of the Interior. Other distinguished panelists were Dr. Robert Thresher, Director, National Wind Technology Center, Washington, D.C., Virginia State Senator Frank W. Wagner, Charles Davidson, Chairman and CEO Noble Energy, Inc. of Houston, and Debbie Boger, Deputy Legislative Director, Sierra Club, Washington, D.C. .

SUBMISSION TO THE U.S. SENATE ENERGY AND NATURAL RESOURCES COMMITTEE OFFSHORE ENERGY HEARING

April 19, 2005

Mr. Chairman, Mr. Ranking Member, and distinguished members of Senate Energy and Natural Resources Committee, I would like to thank you for your invitation to come before your Committee today. I hope that my comments will aid you in making the important decisions that you are considering in this Congress to shape the future of our nation's energy supply. It is imperative that we, as a nation, stop reacting to energy situations imposed on us by outside forces, and instead, proactively start shaping our energy future. One of the ways to do that is to develop the full potential of the nation's offshore energy resources and to assist those states that make that production possible off their coasts. This can be accomplished by sharing with those coastal producing states some of the offshore revenues generated off their coasts. This would encourage those states to pursue more development, and it would help offset infrastructure costs those states incur that are associated with that development.

Louisiana's Role as a Producing and Consuming State

Energy is the lifeblood of an industrialized nation and a key economic driver for the country. A reliable and affordable supply of energy is necessary for economic development, prosperity, and expansion. Although technological improvements and investments in energy efficiency have reduced this country's energy consumption per unit of Gross Domestic Product over the past 20 years, increased economic prosperity is still dependent on increased energy consumption. In the U.S., the availability of energy has generally been taken for granted, but recent blackouts in California and other parts of the country, the emergence of 50 plus dollar per barrel oil and \$7 to \$8 per million BTU (British Thermal Unit) natural gas, and the drive to build terminals to import foreign natural gas in the form of a cryogenic liquid, have highlighted the need for addressing energy supply.

I come to you representing a state to which energy is its middle name. The words Louisiana and energy are almost synonymous. According to the EIA (Energy Information Administration), among the 50 states, Louisiana ranks (2003):

- 1st in crude oil production,
- 2nd in natural gas production, and
- 2nd in total energy production from all sources.

The importance of energy to Louisiana is further highlighted in the following rankings in which Louisiana is (EIA, 2002):

2nd in petroleum refining capacity,
2nd in primary petrochemical production,
3rd in industrial energy consumption, 3rd in natural gas consumption,
5th in petroleum consumption,
7th in total energy consumption,
BUT ONLY 22nd in residential energy consumption.

Usually, when national energy issues are discussed, Louisiana is cast in the image of a rich producing state floating in a sea of oil and gas that is being inequitably shared with the consuming states. Often misunderstood or overlooked is the fact that about two thirds of the production from the state is in the Louisiana federal OCS (Outer Continental Shelf) territory and, hence, produces no revenue for the state, while at the same time incurs significant infrastructure support costs to the state, which I will discuss in more detail later.

Also often overlooked or not explained is the fact that, though Louisiana is the 2nd highest energy producing state in the nation, Louisiana is also 7th highest in total energy consumption. Therefore, Louisiana is more of a consuming state than 43 other states! This story is never told, nor are Louisiana's difficulties as a key consuming state given much concern at the federal energy policy level. Thus, when Louisiana, the energy producing state speaks, it is also Louisiana, the energy consuming state speaking. Louisiana is inexorably tied into the issues of all states in the nation, whether considered producing states or consuming states. However goes the energy situation in Louisiana, so goes the energy situation in the United States of America.

Supplying the Nation: Louisiana – America's Energy Corridor

Louisiana has a long and distinguished history of oil and gas production, providing much of America's energy supply. Currently, nearly 34% of the nation's natural gas supply and almost 30% of the nation's crude oil supply is either produced in Louisiana, produced offshore of Louisiana, or moves through the state and its coastal wetlands. Together with the infrastructure in the rest of the state, this production is connected to nearly 50% of the total refining capacity in the United States.

When it comes to developing the nation's offshore energy resources, there would not be much if it were not for Louisiana's leadership and participation. The OCS territory offshore Louisiana is the most extensively developed and matured OCS territory in the world. According to preliminary 2004 data, the Louisiana OCS presently produces approximately 91% of oil and 75% of natural gas production in the OCS. Louisiana OCS territory has produced 88.7% of the 15.5 billion barrels of crude oil and condensate and 83.2% of the 154 trillion cubic feet of natural gas ever extracted from all federal OCS territories from the beginning of time through the end of 2004.

Stepping up to the plate to help the nation obtain new supplies of energy including LNG (liquefied natural gas), Louisiana is the home of the largest throughput facility (Southern Union in Lake Charles) of the four

existing LNG import terminals in the U.S., and it is undergoing more than a doubling of capacity from 1 billion cubic feet per day to 2.5 billion cubic feet per day. While almost every state in the nation is trying to prevent the siting of any new LNG facilities, Louisiana is the site of the newest permitted LNG terminal (Shell's 1 billion cubic feet per day Gulf Landing facility offshore Louisiana) and of the largest permitted LNG import terminal in the nation (Cheniere Energy's 2.6 billion cubic feet per day facility in Sabine Parish).

The vehement opposition to LNG facilities almost everywhere but in Louisiana and Texas is causing developers to get creative. Such is the case with the offshore Energy Bridge LNG gasification terminal promoted by El Paso Energy and sold to private interests. It is simply a seabuoy attached to a pipeline header to shore. The gasification facility equipment is all located onboard specially constructed LNG tankers using an open seawater system as the heat source for regasification of the LNG. Three such tankers are on order. The first is already operational and has just made its first delivery to the U.S. Although this onboard ship system avoids much of the controversy of siting a permanent LNG terminal, it also liberates the ship from having to unload its cargo at an expensive fixed terminal, enabling it to easily deliver its cargo of LNG to any place in the world that it can merely hook up into a receiving pipeline. This lack of a physical dependence on a limited number of expensive receiving terminals is good for the supplier, but not necessarily for the purchaser, who in the future could be outbid by another purchaser virtually anywhere in the world, which might just not be a seabuoy in the U.S.

Louisiana is also the home LOOP (Louisiana Offshore Oil Port), the only deepwater offshore oil import terminal in the world.

All of this represents only the direct supply line of oil and natural gas. Additionally, Louisiana's 7th highest ranking among the states in energy consumption is attributable to the fact that Louisiana is consuming most of this energy as a through-processor of energy supplies for the rest of the nation, consuming colossal amounts of energy for their benefit. An example of how Louisiana is consuming energy resources for the primary benefit of other states is petroleum refining. The energy equivalent of 10% of Louisiana's entire petroleum product consumption is required just to fuel the processes that refine crude oil into gasoline, diesel fuel, jet fuel, heating oil and other products consumed out of state. The oil refining industry employs only about 10,400 workers in the state; whereas tens of millions of jobs throughout the country are dependent on the affordability and availability of the products from the continued operation of these refineries and associated petrochemical facilities in Louisiana.

Many other examples could be cited of the numerous energy intensive natural gas and oil derived chemical products Louisiana (and also Texas, Oklahoma, and California) through-processes for the rest of the U.S. Per unit of output, these industrial processes in Louisiana are characterized as capital (equipment), energy, raw material, and pollution discharge intensive, and low in labor requirements and dollar value added, essentially the opposite of the downstream industries in other states that upgrade these chemicals into ultimate end products. Much of the energy Louisiana technically consumes is really the transformation of oil and gas into primary chemical building blocks that are shipped to other states where the final products are made, whether it be plastic toys, pharmaceuticals, automobile dash boards, bumpers and upholstery, electronic components and cabinets, synthetic fibers, or thousands of other products dependent on this flow of energy and high energy content materials out of Louisiana.

Governor Blanco has asked me to convey to you today the State's desire to not only continue this production, but to seek additional ways to increase it and to continue to insure that this supply is provided to the rest of the nation and to ask for your help in doing so. You see, we in Louisiana understand just how vital these energy resources are to the nation's economy.

OCS Infrastructure and Its Impacts and Needs

It is important to understand that there is no free lunch. Louisiana, like other coastal producing states, sustains impacts on coastal communities and bears the costs of onshore infrastructure required to support this production activity. In Louisiana, pipelines, canals, and other infrastructure features contribute to the loss of more than 24 square miles of our coastal land each year. In fact, and Mr. Chairman, you have heard me say before that if what is happening today in coastal Louisiana were happening in our nation's capital, the Potomac River would be washing away the steps of this building today, the White House next year, and the Pentagon soon after that. In fact, during the course of this morning alone, Louisiana will lose a football field wide area from the Capitol Building to the Washington Monument.

There are many causes of this coastal erosion in Louisiana, including what may be the most significant factor: building levees and channeling the Mississippi River. Whatever the cause of its demise, the health and restoration of Louisiana's coastal wetlands are vital to protecting the offshore and onshore infrastructure that is essential for the continuation, as well as the expansion, of offshore energy production in the Gulf of Mexico.

Obsolete Practices of the Past Cause Louisiana's Problems Today

This raises one issue I would like to address. If offshore exploration and production causes or adds to coastal erosion and other environmental harm, why would any state want to support it? Simply stated, Louisiana's environmental damage issues pertaining to petroleum drilling and production are primarily related to two issues:

- (1) Forces of nature that have nothing to do with the petroleum industry, but which threaten its existence, and
- (2) Impacts from legacies of obsolete practices of the past continuing to cause problems in Louisiana's ultra-fragile mostly marsh coastline.

Louisiana's first well was drilled in 1868. The first oil well over water in the world was in Louisiana in 1910 in Caddo Lake. The first well drilled offshore Louisiana was in 1933 near Creole, Louisiana. Louisiana was the site of the first well drilled out of sight of land in 1947.

Things have changed dramatically since 1910, 1933, 1947, or even 1960, 1970, or 1980. Offshore drilling was pioneered in Louisiana, long before modern sensitivity to the environment, advanced technology and environmental regulations. Simply put, it was like the old Wild West out there. Once, hardly anybody gave a second thought to the oil companies slicing and dicing the coastline to build canals and pipelines or to discharging produced water and drilling fluids overboard; it was all considered a sign of progress.

Everything is different now. That world and those practices have nothing more in common with modern exploration and production techniques than Conestoga wagons crossing the Oregon Trail in the 1800's have in common with jet airliners flying overhead today. Offshore development and the associated onshore infrastructure construction and operation are done in an environmentally responsible way today and under the oversight of several State and federal regulatory agencies.

Once the State realized the magnitude of the coastal erosion problem, we got serious about doing something about it. In 1980, the coastal restoration permitting program was moved to the DNR (Department of Natural Resources). In 1981, \$40 million of state oil and gas revenue was set aside in a legislative trust fund for coastal restoration projects. The State has a dedicated revenue stream of up to \$25 million per year, depending on the level of revenue collections from oil and gas production within the state, to replenish the fund. In the past few years, that replenishment stream has been at the \$25 million level. In 1989, the Office of Coastal Restoration and Management was created in DNR, and the magnitude of the program was greatly expanded.

Extent of Louisiana Infrastructure Supporting OCS Production

The total value of the Louisiana OCS infrastructure and the onshore infrastructure supporting it is difficult to ascertain. The estimated depreciated investment in offshore production facilities is over \$85 billion, depreciated offshore pipeline infrastructure is over \$10 billion, and public coastal port facilities is \$2 billion, for a total of approximately \$100 billion, depreciated, and not counting highways, sewer, water, fire and police protection, replacement of all of this would be several times the \$100 billion depreciated figure. It also does not count the onshore coastal infrastructure of pipelines, storage facilities, pumping stations, processing facilities, etc.

This infrastructure is vulnerable if not protected by the State's barrier islands and marshes. As these erode and disappear, infrastructure is exposed to the open sea and all of its fury. As the coast recedes, near shore facilities become further offshore and subject to greater forces of nature, including subsidence, currents, and mudslides. Erosion in the coastal zone is already beginning to expose pipelines that were once buried.

A Wake-up Call from Hurricane Ivan

To bring home the point of infrastructure vulnerability, we need only look back to this past Summer. Hurricane Ivan was not even a direct hit on Louisiana's offshore and coastal oil and gas infrastructure, striking two states away; yet, its effects on the nation's supply of oil and gas were significant, even many months after it hit. Most of the damage occurred along pipeline routes rather than actual structural damage to the producing platforms. As of February 14, 2005, when the Minerals Management Service (MMS) released its final impact report on Ivan, 7.42% of daily oil production and 1.19% of daily gas production in the Gulf of Mexico was still shut-in. The cumulative shut-in production through February 14 was 43.8 million barrels or 7.25% of annual Gulf of Mexico OCS production and 172.3 billion cubic feet of natural gas or 3.9% of annual Gulf of Mexico OCS gas production.

As more of the protection from Louisiana's barrier islands and coastal wetlands wash away, increasingly more of this offshore production will be damaged or destroyed by even less powerful storms than Ivan, and particularly by storms whose paths more directly pass through the producing areas off of Louisiana's coast. Direct hits to the prime production area by hurricanes and tropical storms will cause incalculable damage to this production infrastructure, as well as to the onshore support infrastructure.

How to Increase Offshore Energy Production

Share Offshore Revenue with the States that Allow Offshore Production

When states like yours, Mr. Chairman, host drilling on Federal lands onshore, they receive 50% of those revenues in direct payments, and consequently have the financial resources to support that infrastructure. In Fiscal Year 2004, Wyoming and New Mexico together received about \$928 million from those revenues, which is an appropriate revenue sharing procedure.

In contrast, for example in 2001, of the \$7.5 BILLION in revenues produced in the federal outer continental shelf area, only a fraction of one percent came back to those states. The inequity is truly profound.

We are pleased this committee is investigating ways to increase offshore energy supply. The need to sustain the existing supply that Louisiana provides must simultaneously be addressed. The most effective answer to both issues is to share offshore revenues with the coastal producing states that make that production possible. It is critical that coastal producing states receive a fair share of revenues to build and maintain onshore infrastructure and, in Louisiana's case, to help stem our dramatic land loss, which is occurring at a rate believed to be the fastest on the planet.

Production off Louisiana's shores alone contributes an average of \$5 BILLION a year to the Federal treasury, its second largest source of revenue.

Does it not make sense to encourage the coastal producing states which provide that revenue for the benefit of the rest of the nation? Does it not make sense, that when so many, like the U.S. Ocean Commission, are targeting offshore OCS revenues to pay for worthwhile preservation of natural resources, that this nation first protects those who make these resources possible?

Already, in Louisiana's coastal zone, many of the pipelines and other infrastructure that our wetlands have historically protected are now exposed to open Gulf of Mexico conditions.

I shudder to think of the environmental damage and the economic impacts to this nation, had Ivan gone a relatively few miles further west with a direct hit on the infrastructure off Louisiana's shore. According to analysts, oil prices would realistically have hit \$75 dollars a barrel.

Maintaining any ongoing operation requires reinvestment to maintain, repair, and replace worn out or outdated equipment and facilities. As any farmer can tell you, you cannot just take from the land forever without putting something back into the operation. Out of the harvest of crops, the farmer has to set aside

a portion as seed to plant for the next harvest. He has to fertilize the land to replace depleted nutrients, plow and till the soil, rotate crops, control runoff and erosion, irrigate, apply pesticides and herbicides, buy and repair machinery. Likewise, to maintain, much less increase, production from off our coasts, we must reinvest in the infrastructure that makes all of the activity possible, whether it be port facilities, roads to transport equipment and supplies, erosion control, or barrier island and wetlands storm protection.

*Extend Section 29 Tax Credits to Deep and Ultra-Deep Production
in States Allowing Offshore Production*

Section 29 of the IRS (Internal Revenue Service) Code granted a tax credit for the production of natural gas from unconventional resources (coal bed methane and tight sands gas). The effect of the application to coal bed methane gas production was astounding in those areas of the country that have significant deposits of this kind, which is not along the Gulf Coast. Natural gas reserves from coal bed methane rose from 6.3% of U. S. reserves at the end of 1993 to 9.9% at the end of 2003. Annual natural gas production from coal bed methane rose from 4.2% of U. S. dry gas production in 1993 to 8.2% by the end of 2003.

Deep natural gas reserves (15,000-24,999 feet sub-surface) and ultra-deep gas reserves (greater than 25,000 feet sub-surface) are the next most immediate resources for meeting the supply and deliverability needs of the U. S. market. These resources should be granted the same tax credit as was granted to coal bed methane producers. The resulting stimulus to production should be at least equal to the coal bed methane results, and would very likely far exceed it in time as capital is brought to bear on this drilling domain. The MMS has recently instituted significant deep shelf royalty incentives for the shallow federal waters of the Gulf of Mexico shelf. This does no good for the adjacent state waters and onshore areas. The Section 29 credits need to be instituted for state waters and onshore areas, at least in those states allowing federal offshore production.

Encourage New Energy Sources and Technology

Recent studies show that the Gulf of Mexico has a significant wind energy potential. Although wind power does not have the energy density of petroleum, it is an inexhaustible, renewable source of clean energy. Again, much to my consternation, it appears that there are many parts of the country that use a lot of energy and want it low prices, but do not want the production of any kind, anywhere near them, including wind energy. Again, Louisiana is stepping up to help encourage this clean energy source. The State of Louisiana is currently working with private sector investors who are interested in developing wind farms in state and federal waters off Louisiana's coasts. My office is submitting wind power legislation before the Louisiana Legislature in the session starting later this month, to facilitate offshore wind power development in Louisiana's State offshore waters.

Natural gas hydrates probably offer the greatest untapped energy resource the nation has. The Oil and Gas Journal recently reported that the U.S. Geological Survey estimates that methane hydrate deposits are greater than all other forms of fossil fuels combined. Large deposits of gas hydrates are believed to lie

below the offshore waters of the U.S. Unfortunately, technology to tap these resources needs to be developed. Once the technology is available, the first areas to be developed will be the areas adjacent to the existing offshore producing areas where the infrastructure is in place to get it to shore and into the nation's pipeline distribution system. The federal government needs to fund meaningful research into developing the technology to produce gas hydrates, assessing the resource base, and producing it.

In Conclusion

It is vital to the nation's security and prosperity that new energy sources be developed. The federal government has proven that it has the ability to steer investment, as in the case of deep water drilling in the Gulf and coal seam gas. In addition to its significance in producing 30% of oil and 23% of natural gas produced domestically, which is mostly off Louisiana, the OCS is probably the single most promising area for the

U.S. to obtain significant new energy supplies. These supplies, whether conventional oil and gas, imported oil, imported LNG, wind and ocean energy, or gas hydrates, need the support of coastal states to cooperate and to supply and maintain critical production and support infrastructure.

LNG facilities are being built where the existing U.S. pipeline infrastructure exists (essentially Louisiana and Texas) in order to get the gas from the coast into the delivery system to supply the nation. The same will be true when the technology is developed to commercialize methane hydrate production off the coasts. This Louisiana and Texas infrastructure will also be used when deep and ultra-deep shelf production comes on stream. This is another reason why offshore revenue should be shared with the coastal producing states and why the extension of Section 29 tax credits should be extended to deep gas exploration at least in the states that are allowing onshore and offshore drilling and allowing the siting of LNG facilities to make energy available to the rest of the country.

With effective policies and incentives, the federal government can steer investment into the offshore areas, and by receiving an equitable share of revenue generated offshore, the coastal producing states can be in a position to ensure that this production will be made available to the rest of the nation. As the granddaddy of all producing states, literally and figuratively, Louisiana desperately needs immediate revenue sharing financial assistance from a source not subject to annual appropriations, to continue to maintain existing, and to develop future energy supplies for the nation. Governor Blanco is submitting legislation for a State constitutional amendment to dedicate to coastal projects, any future new OCS revenue the State may receive, to show Louisiana's commitment to use money the federal government shares with the State to put into coastal restoration to rebuild and protect the OCS production infrastructure.

It would be a travesty for the Congress to enact national energy legislation without substantial OCS revenue sharing in the form of direct payments to the coastal producing states from the revenue derived from offshore production, similar to the automatic payments for drilling on federal lands onshore, and before any other dispersal of those monies.

Thank you for this opportunity to appear before you.

FUEL CELLS PAST, PRESENT AND FUTURE

Fuel cells have been receiving a lot of attention recently. President George W. Bush, in his 2003 State of the Union Address, announced a \$1.2 billion hydrogen fuel incentive to assist with the technology development for hydrogen powered fuel cells for vehicles, homes and businesses. On February 10, 2004, General Motors and Dow Chemical started the first of 400 hydrogen powered fuel cells which will convert hydrogen produced at the Dow plants to electricity. The electricity will be used to help power the plants. Several automobile manufacturers have introduced fuel cell cars, including Honda (see Figure 1), General Motors, Ford and Toyota.



FIGURE 1
(Courtesy of Honda Motor Company)

Fuel cell powered vehicles are not new. The first fuel cell vehicle was built in 1959. The alkaline fuel cell powered tractor was built by Allis Chalmers, used to plow a field in Wisconsin and then donated to the Smithsonian (see Figure 2).



FIGURE 2

(Courtesy of the Smithsonian Institution)

Fuel cells have been used to power all sorts of vehicles, such as buses, airplanes, fork lifts, scooters (Figure 3), lawn mowers and submarines.



FIGURE 3

(Courtesy of Honda Motor Company)

Fuel cells are classified by their electrolyte and its operational characteristics. The most promising types include Polymer Electrolyte Membrane (PEM), Phosphoric Acid, Direct Methanol, Alkaline, Molten Carbonate, Solid Oxide and Regenerative (Reversible).

The polymer electrolyte membrane fuel cell (see Figure 4), with its light weight and low operating temperature of less than 200°F, is favored for vehicular applications. PEM's operate on hydrogen, oxygen (from air) and water. The pure hydrogen is typically stored at high pressure in onboard tanks. Hydrogen's low density prohibits the storage of enough fuel for comparable travel distance as gasoline powered vehicles.

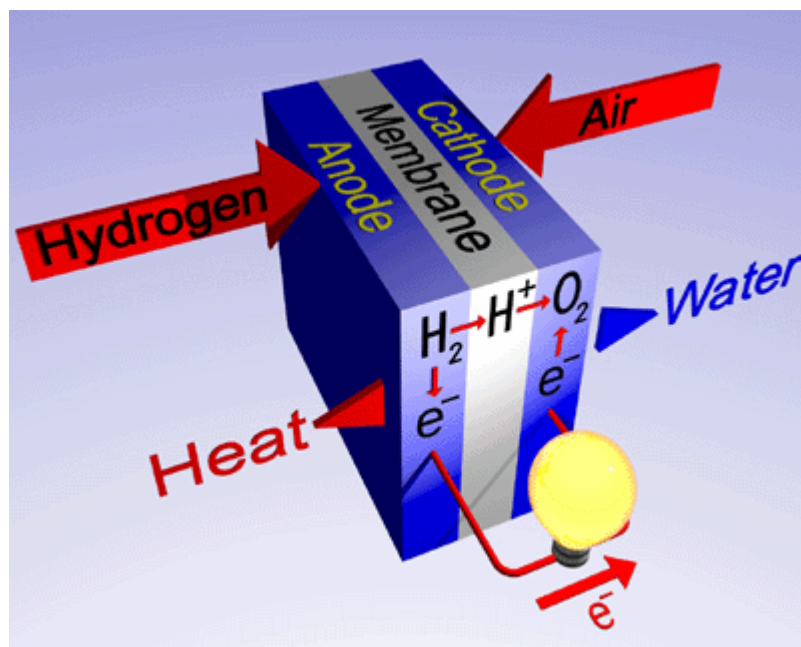


FIGURE 4
(Courtesy of Fuel Cell Today)

Hydrogen refueling stations will be required similar to gasoline stations that we utilize today. Other fuels can be used, but must be reformed onboard, which drives up the purchase price and maintenance costs. The reformer also releases carbon dioxide.

Alkaline fuel cells are one of the oldest technologies. The electrolyte used is a potassium hydroxide and water solution. AFC's are 60% efficient and have been used for the production of electrical power and water on Gemini and Apollo spacecraft, but their short operating time renders them less than cost effective in commercial applications. Their susceptibility to poisoning by even a small amount of carbon dioxide in the air requires purification of the hydrogen and oxygen. This problem adds to the cost of the fuel cell and shortens its operating cycle.

A newer and promising fuel cell technology is the direct methanol fuel cell (DMFC). The DMFC uses pure methanol mixed with steam. Liquid methanol has a higher energy density than hydrogen, and the existing infrastructure for transport and supply can be utilized. Research and development on DMFC's are 3 – 4 years behind other fuel cell technologies.

Over 200 phosphoric acid fuel cells (PAFC) are being used today, primarily for stationary power generation. Since phosphoric acid fuel cells are less efficient, they tend to be large, heavy and expensive. The efficiency is increased from approximately 40% to 85% when used for cogeneration.

Molten carbonate fuel cells (MCFC) have several advantages. Their efficiency can approach 85% if waste heat is used. MCFC's are not prone to poisoning from carbon monoxide or carbon dioxide, and the fuel cell can actually use these oxides as fuel. The 1200°F operating temperature reforms the fuel to hydrogen within the fuel cell. The high temperature also allows the use of non-precious metals as catalysts. All of these features help reduce the cost of this type of fuel cell. The major disadvantage is component breakdown caused by the high operating temperature and corrosive electrolyte, which reduces the life of the cell.

Another high temperature unit is the solid oxide fuel cell (SOFC) which operates at 1830°F using a hard, non-porous ceramic compound as the electrolyte. Most of the attributes of MCFC's also apply to SOFC's. Additionally, a solid oxide fuel cell can be fueled by gases made from coal, since it is the most sulfur resistant of the fuel cell types. Efficiency of this fuel cell is normally 50 – 60%, but improves to 80 – 85% with waste heat recovery.

The newest fuel cell is the reversible or unitized regenerative fuel cell (URFC). Similar to other types, the regenerative fuel cell can produce electricity from hydrogen and oxygen while generating heat and water. They can also use electricity to divide the excess water into oxygen and hydrogen, which are stored for subsequent fuel cell consumption. The electricity for this electrolysis process can even come from solar power. The URFC is lighter than a separate electrolyzer and generator making it a good choice for weight conscious projects such as fuel cell powered vehicles.

A recent project at the University of Louisiana at Lafayette provided hands-on experience with designing, procuring, installing and operation of a fuel cell. The project, which was funded by the Louisiana Department of Natural Resources and the U. S. Department of Energy, involved the utilization of a 5 kW PEM fuel cell (see Figure 5) to provide power for a small campus building. Detailed engineering analysis and economic assessments were performed on the potential integration of the fuel cell and the installed desiccant dehumidification system in a combined heat and power (CHP) mode. Although the project proved that the installation and operation of such a system is feasible, it cannot show economic savings until operating efficiency, manufacturing cost and fuel cell life are significantly improved. Another major aspect of this project was the connection of the fuel cell to the electric grid of Lafayette Utilities System.



FIGURE 5

Although fuel cells have been around for many years, and are receiving more attention than ever before, they are still not economically feasible in many applications. As designs improve and manufacturing matures, fuel cells could become the power source of the future.

SELECTED LOUISIANA ENERGY STATISTICS

Among the 50 states, Louisiana's rankings (in 2004 unless otherwise indicated) were:

PRIMARY ENERGY PRODUCTION

(Including Louisiana OCS)

- 1st in crude oil
- 2nd in natural gas
- 2nd in total energy

REFINING AND PETROCHEMICALS

- 2nd in refining capacity
- 2nd in primary petrochemical production

PRIMARY ENERGY PRODUCTION

(Excluding Louisiana OCS)

- 5th in natural gas
- 4th in crude oil
- 8th in total energy

ENERGY CONSUMPTION* (2003 preliminary)

- 3rd in industrial energy
- 3rd in per capita energy
- 3rd in natural gas
- 5th in petroleum
- 8th in total energy
- 22nd in residential energy

PRODUCTION

State controlled (i.e., excluding OCS) natural gas production peaked at 5.6 TCF per year in 1970, declined to 1.5 TCF in 1995, and rebounded 4.5% to 1.6 TCF in 1996. The 2001 gas production was, approximately, 1.50 TCF, the 2002 production was around 1.36 TCF, the 2003 and the 2004 gas production was 1.35 TCF.

State controlled gas production is on a long term decline rate of 3.8% per year, though the current short term (2005-2009) forecast decline is around 3.4% per year.

State controlled crude oil and condensate production peaked at 566 million barrels per year in 1970, declined to 127 million barrels in 1994, recovered to 129 million barrels in 1996, and declined to 83.6 million barrels in 2004.

State controlled crude oil production is on a long term decline rate of 4.2% per year, though the current short term (2005-2009) forecast decline is around 3.9% per year. If oil stays above \$50.00 per barrel, the decline will remain as predicted. If the price drops below \$45.00 per barrel, the decline rate may be higher.

Louisiana OCS** (federal) territory is the most extensively developed and matured OCS territory in the US.

Louisiana OCS** territory has produced 88.8% of the 14.9 billion barrels of crude oil and condensate and 82.3% of the 150 TCF of natural gas extracted from all federal OCS territories from the beginning of time through the end of 2003.

Louisiana OCS** gas production peaked at 4.16 TCF per year in 1979, declined to 3.01 TCF in 1989, then recovered to 3.98 TCF in 1999, and fell to 3.30 TCF in 2003.

Louisiana OCS** crude oil and condensate production first peaked at 388 million barrels per year in 1972 and declined to 246 million barrels in 1989. In this decade, the production has steadily risen from 264 million barrels in 1990 to 540 million barrels in 2003 due to the development of deep water drilling.

REVENUE

At the peak of Fiscal Year (FY) 1981/82, oil and gas revenues from severance, royalties, and bonuses amounted to \$1.6 billion, or 41% of total state taxes, licenses and fees. For FY 2004/05, these revenues are estimated to be in the vicinity of \$1,180 million, or about 13.1% of total estimated taxes, licenses, and fees.

At constant production, the State Treasury gains or loses about \$13 million of direct revenue from oil severance taxes and royalty payments for every \$1 per barrel change in oil prices. This figure rises to \$17 to \$22 million per dollar change when indirect revenue impacts are included (e.g., income tax, sales tax, etc.).

For every \$1 per MCF changes in gas prices, at constant production, the State Treasury gains or loses \$47 million in royalty payments, and would add or subtract 3.8 cents per MCF from gas full severance tax rate for the following fiscal year (there is a 7 cents floor on gas severance tax). There are no studies available on indirect revenue to state from changes on gas prices

DRILLING ACTIVITY

Drilling permits issued on state controlled territory peaked at 7,631 permits in 1984 and declined to a low of 1,017 permits in 1999. In 2002 drilling permits issued fell to 1,025 permits, in 2003 rebounded to 1,264 permits, and in 2004 increased to 1,633 permits.

The average active rotary rig count for Louisiana, excluding OCS, reached a high of 386 rigs in 1981 and fell to 64 active rigs in 1993. In 2001 it recovered to 108 active rigs, then fell to 76 active rigs in 2003, and swung back to 91 active rigs in 2004.

The 2004 average active rotary rig count for Louisiana OCS was 76 active rigs, 5 rigs, or 6.6% lower than 2003 average, and the highest active rotary rig count was 109 rigs recorded in 2001. In 2000, the average active rig count was 108 or 42.6% higher than the 1999 average active rotary rigs.

*** Ranking estimated by DNR-TA summing pertinent fuels sources from DOE-EIA natural gas, petroleum, and coal annuals**

****** Note: Louisiana OCS or Outer Continental Shelf is federal offshore territory adjacent to Louisiana's coast beyond the three mile limit of the state's offshore boundary.

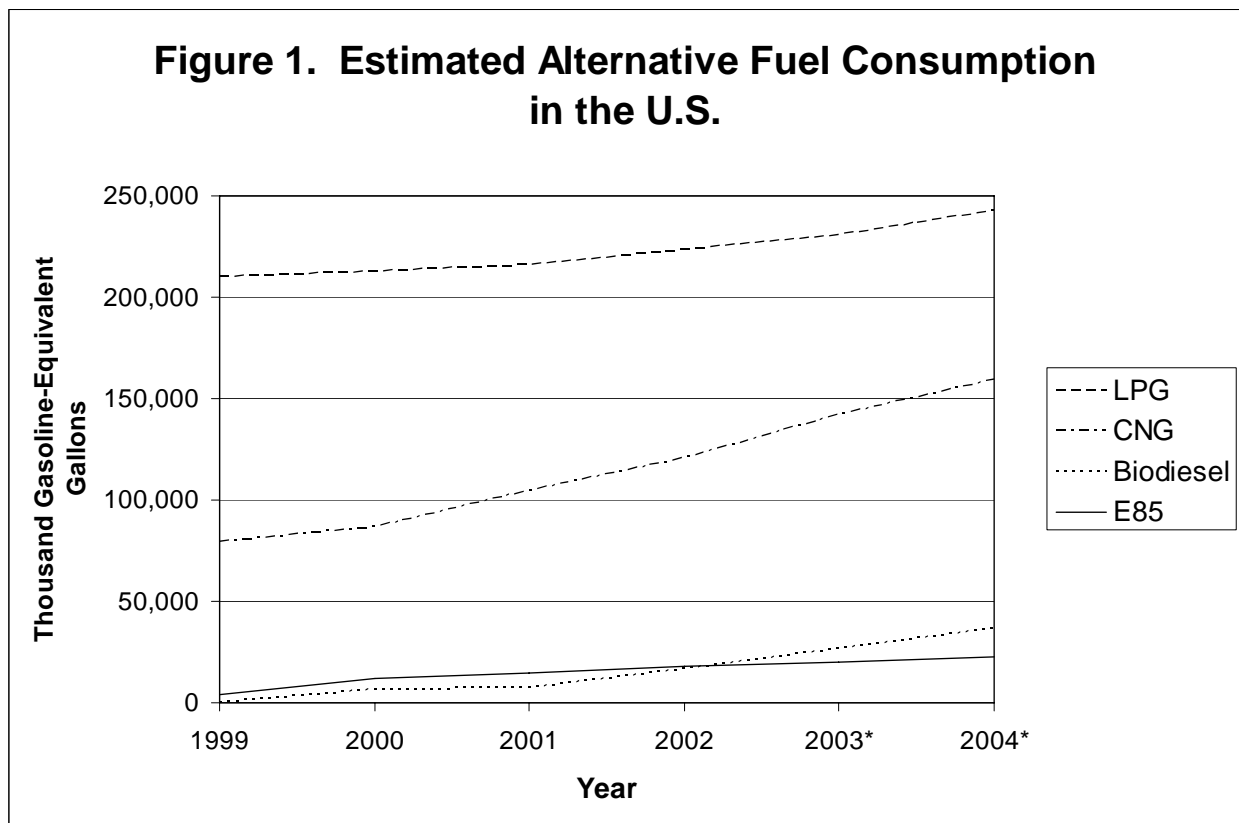
TCF= trillion cubic feet

ALTERNATIVE MOTOR VEHICLE FUELS IN LOUISIANA JUNE 2005 UPDATE

by Bryan Crouch, P.E.

Executive Summary

Alternative fuel usage in the U.S., as well as in Louisiana, remains a minor fraction of total motor vehicle fuel consumption. In 2004, motor vehicles in the U.S. consumed over 177 billion gasoline-equivalent gallons of fuel ¹ (a gasoline-equivalent gallon, also referred to as a gallon-gasoline equivalent, or gge, is a unit that expresses different fuels on an equivalent energy per volume basis). Out of the 177 billion gge of fuel consumed, about 2.5 billion gge (less than 1.5% of the total) were alternative fuels, which includes about 2 billion gge of ethanol used to blend with gasoline to make gasohol ¹. Figure 1 shows the estimated consumption of the four most used alternative motor vehicle fuels in the U.S.



* Projected

Typical motivations to use alternative motor vehicle fuels include energy security, energy sustainability, and environmental sustainability. In addition, recent high oil prices and a post-911 awareness of the vulnerability of our oil supplies have served to increase national attention on alternative fuels. In Louisiana, these effects have been amplified by the Baton Rouge area's classification as an ozone non-attainment area by the U.S. Environmental Protection Agency (EPA); this has served to increase interest and activity related to alternative fuels. The major obstacles to wide-spread alternative fuel usage

continue to be the generally higher cost of alternative fuels and vehicles, and the lack of fueling infrastructure.

These motivations translated into goals are: to reduce crude oil imports, to find a replacement for crude oil, and to reduce emissions resulting from fuel combustion. Two of the more recent developments that are gaining momentum nationally and helping to accomplish these goals are hybrid-electric vehicles and biodiesel. Making gasoline or diesel fueled vehicles more fuel efficient also helps to reach these goals. Such is the case with hybrid-electric vehicles (HEVs). HEVs are not alternative fuel vehicles (they use gasoline or diesel), but employ advanced technology to increase miles per gallon. HEVs are rapidly increasing in sales and availability, and their use reduces both emissions and our nation's dependence on imported crude oil. Biodiesel is a newer alternative fuel that is rapidly gaining popularity due to its ease of use, emission reduction benefits, and renewable status. Biodiesel also has much potential as an additive to regular diesel to restore the lubricity that will be lost when Environmental Protection Agency regulations take effect in mid 2006 that require the sulfur content in diesel to be reduced from 500 parts per million to 15 parts per million.

Fuel cells probably have the greatest potential for replacing internal combustion engines in vehicles. Fuel cell vehicles and related technologies continue to advance, but still remain in the experimental stage. Several test fleets are in operation in the U.S. and Japan, and are providing valuable data to manufacturers. Many technological and economic barriers still exist and must be overcome before mass produced fuel cell vehicles and fueling infrastructure becomes a reality.

HIGHLIGHTS

Biodiesel

Biodiesel is a renewable fuel that can be made from virgin or waste vegetable oils, animal fats, and even algae, by reacting the base oil (vegetable oil, etc.) with alcohol and a catalyst. Unlike vegetable oil, biodiesel has combustion properties very similar to crude-based diesel, and is biodegradable, non-toxic, and sulfur free. Using biodiesel reduces VOC emissions by 67%; CO and particulate matter emissions by almost 50%; and CO₂ emissions by almost 80%. NO_x is increased by approximately 10%. Biodiesel can be blended with crude-based diesel in any proportion and is referred to as "BXX" with the "XX" standing for the percentage of biodiesel in the blend. Common blends are B2, B5, and B20. The term "biodiesel" refers to B100, or pure biodiesel. Only B100 qualifies as an alternative fuel under EPACT regulations, but EPACT covered fleets earn one credit per 450 gallons of B100 purchased if used in blends of 20% or higher.

Any biodiesel blend can be used in any diesel engine subject to the following cautions. Biodiesel has excellent solvent properties, and as such, can dissolve deposits left behind by regular diesel (which can clog fuel filters). Fuel filters should be changed more frequently until the biodiesel has had sufficient time to remove deposits. The second caution concerns cold weather usage. Just like regular diesel, biodiesel can gel at low temperatures. The temperature at which biodiesel becomes problematic is higher than that of regular diesel, but the same methods of intervention that are used for regular diesel (external heating and additives) can be used for biodiesel. As a general rule, B20 has a 3 to 5 degree F increase in cold flow properties over regular diesel. The higher the blend, the higher the temperature at which gelling will occur.

Biodiesel production has grown from 5 million gallons in 2000 to over 25 million gallons in 2003. No biodiesel is currently produced in Louisiana. B100 costs range from \$2 to over \$3 per gallon. B20 currently sells for \$0.20 to \$0.30 per gallon more than regular diesel.

Biodiesel is also an excellent lubricity additive for regular diesel fuel. A diesel engine relies on the inherent lubricity of diesel fuel to lubricate its fuel injection system. Diesel fuel derives most of its lubricity from the sulfur it contains. In 2006, federal ultra low sulfur diesel regulations go into effect and will reduce the amount of sulfur in diesel to below 15 parts per million and thereby reduce lubricity to unacceptable levels. A B2 blend can restore the lost lubricity.

The National Biodiesel Board is the premier trade association for the biodiesel industry. Their website (URL: <http://www.biodiesel.org/>) contains a wealth of information on all things related to biodiesel.

Hybrid Electric Vehicles

HEVs use electrical and mechanical energy to propel the vehicle by combining an internal combustion engine with an electric motor(s) and batteries. The result is a vehicle that is operated and fueled like a conventional vehicle, but is much more fuel efficient, and thus, less polluting.

An HEV can be designed to operate in one of three modes, series, parallel, or a combination of the two. An HEV configured for series operation uses an internal combustion engine to run a generator which charges batteries, which powers an electric motor, which then drives the wheels. Series HEVs allow the internal combustion engine to constantly run at its most efficient speed, thereby reducing emissions, but require large, expensive batteries due to the fact that all of the power required to propel the vehicle must come from the electric motor. An HEV configured for parallel operation can use either the internal combustion engine or the electric motor, or both in varying proportions, to drive the wheels. This configuration results in more power being available for acceleration, and allows the use of smaller, less expensive batteries. Parallel HEVs also are generally able to utilize smaller internal combustion engines due to the engines proportion of motive energy being applied directly rather than first being converted to electrical energy. Finally, combination HEVs are configured such that they can operate in either series or parallel mode.

HEVs also use regenerative braking to help charge the batteries. Regenerative braking recovers some of the energy that would normally be lost while a vehicle is decelerating. It works by using the rotational kinetic energy of a vehicles drivetrain while the vehicle is decelerating to drive a generator to charge the batteries. This, in turn, requires less use of the internal combustion engine to charge the batteries, which increases overall efficiency.

Honda, Toyota, and Ford have light-duty HEVs currently available ranging from a \$20,000 small two-seater to a \$50,000 mid-size sport utility vehicle. These HEVs sell at a \$3,500 to \$7,000 premium to comparable gasoline-only vehicles, and have fuel efficiencies ranging from 30 to 60 mpg. Several other major manufacturers will have light-duty HEVs for sale in the very near future. Heavy-duty HEVs, mainly busses and delivery vans, are available from several manufacturers. More information on HEVs, including a listing of available models, is available on the Clean Cities Program HEV webpage (URL: <http://www.eere.energy.gov/cleancities/hev>).

Federal Tax Incentives

A federal tax deduction for clean-fuel vehicle property was authorized under EPACT according to the following schedule:

- Up to \$50,000 for a truck or van with a gross vehicle weight rating over 26,000 pounds, or for a bus that seats at least 20 adults plus a driver.
- Up to \$5,000 for a truck or van with a gross vehicle weight rating between 10,000 and 26,000 pounds.
- Up to \$2,000 for any other on-road vehicle, including HEVs.

- Up to \$100,000 per location for clean-fuel refueling property or recharging property.

A federal electric vehicle tax credit was also authorized under EPACT. The amount of the credit is equal to the lesser of 10% of the cost of an electric vehicle or \$4000.

Both the clean-fuel vehicle property tax deduction and the electric vehicle tax credit were scheduled to be gradually phased out over the period from 2001 to 2004; however, the Working Families Tax Relief Act of 2004 extended the full amount of the incentives through 2005. The incentives will be reduced by 75% for 2006 and eliminated after that.

The American Jobs Creation Act of 2004 authorized an excise tax credit for producers and blenders of biodiesel and ethanol. The credit for ethanol is \$0.51 per gallon; the credit for biodiesel is \$1.00 per gallon for agri-biodiesel (biodiesel produced solely from virgin oils and animal fats) and \$0.50 per gallon for any other biodiesel.

The Alternative Fuels Data Center website contains a page with up to date information on federal tax incentives (URL: http://www.eere.energy.gov/afdc/progs/search_state.cgi?afdc/US).

Louisiana Tax Incentives

Louisiana Revised Statute 47:38 offers a state income tax credit of 20% of the incremental cost of purchasing a factory-equipped AFV, 20% of the cost for converting a vehicle to alternative fuels, and 20% of the cost for alternative fuel refueling stations. If a taxpayer is unable or elects not to determine the incremental value of an OEM AFV, the taxpayer may claim a credit of 2% of the cost of the vehicle or \$1500, whichever is less.

The Louisiana Department of Revenue has issued two recent rulings regarding what qualifies for the alternative fuel income tax credit. Ruling 02-019 concludes that hybrid-electric vehicles qualify for the tax credit, and ruling 03-004 concludes that low-speed vehicles qualify for the credit. The text of the rulings is included in Appendix B, and is also available on the Department of Revenue's website (URL: <http://www.rev.state.la.us/sections/lawspolicies/pd.asp>).

OBSERVATIONS ON PROGRESS OF ELECTRICITY DEREGULATION IN THE U.S.

by

Paul R. Sprehe, Energy Economist

Patricia Nussbaum, Engineer

It would be an understatement to say that the electric power generation sector of the economy is suffering “convulsions” from the restructuring initiative unleashed by the Energy Policy Act of 1992 (EPACT92). The subsequent patchwork of individual state Public Service Commission (PSC) regulatory actions adopted across the nation have left the country with:

- a stalled deregulation initiative
- a significant financial commitment to new natural gas power generation technology
- a volatile natural gas price regime
- natural gas supply uncertainty
- huge financial write downs of power generation investments on the balance sheets of both regulated and unregulated firms
- power blackouts that affect regions of states, not just community localities
- criminal behavior and market collusion among some power trading and marketing companies; bankruptcies of utilities
- criminal indictments of corporate utility executives
- the near bankruptcy of the State of California
- soaring electric power prices; some states requiring disaggregating of integrated firms
- some states allowing integrated operations
- renewed dialogue about the environmental viability of coal and nuclear power generation in the nation’s future
- a significant downgrading of the credit quality of the nation’s utilities in general
- a disagreement between state PSCs and the Federal Energy Regulatory Commission (FERC) over regulation of transmission of electric power
- who should regulate siting of new transmission facilities
- and on and on.

Cogeneration of electric power by industrial firms, both for internal process plant use and for the sale of excess power into the market, has grown rapidly since EPACT92. But now the volatility of natural gas prices, and the apparent uncertainty of domestic natural gas supply, has driven many plants, particularly those utilizing natural gas in their processes, out of business here in the U.S. and toward relocation overseas where natural gas supply and labor are less costly. With so much electric power generation dependent on natural gas supply to Independent Power Producers (IPPs) and cogeneration facilities, both in Louisiana and nationally, the dependability of electric power generation becomes a legitimate public policy issue for the consuming public. The planning and financing of coal and nuclear fired power generation, to replace natural gas as a source of power generation, requires many years of preparation.

Given the rate of change in the power generation sector, even this data is a work in progress. Publication of actual generation data lags by several months, and is the subject of revision as respondents complete their filing requirements.

Louisiana's investor owned and publicly owned utilities both generate and distribute electric power to the consumer. Prior to its bankruptcy filing, Cajun Generation and Transmission Co-op served its distribution cooperatives. The survivor entity to Cajun now serves as an IPP. The cooperative distribution entities remain as distribution utilities within Louisiana. As in most industrial states, cogeneration of both heat for processes and power generation for internal consumption, as well as for sale to the transmission network, has become more economic with rising natural gas prices. In 2002, nearly 42% of generating capacity in the state came from IPPs and cogeneration. Investor owned utilities continue to dominate the Louisiana market place with nearly 75% of the customers, 85% of power sales, and 55% of the electric power generation facilities.

Natural gas retains its role as the dominant source of fuel for electric power generation in the state. Natural gas provides 40% of the aggregate electric generating capacity, and up to 75% when dual fuel capacity is considered. Most dual fuel capacity power generation combines the ability to interchange distillate or diesel fuel, and natural gas. Natural gas, of course, dominates the IPP and cogeneration applications.

In the aggregate, 50% of Louisiana's electric power generation relies on natural gas as its fuel source. Nearly 23% comes from coal fired generation; and nearly 18% from nuclear power.

There are 22 cities in Louisiana that own their own independent municipal power distribution systems. The Louisiana Energy and Power Authority (LEPA) was created as a political subdivision of the State of Louisiana in 1979 pursuant to Title 33 of the Louisiana Revised Statutes of 1950. LEPA is a non-profit, joint action agency working to provide its member communities with firm, stable sources of electricity at the lowest possible cost (LEPA Mission Statement). Eighteen (18) Louisiana municipalities are currently members of LEPA.

The preceding, as well as a compendium of statistics on Louisiana electric utility generation, independent power producers, and cogeneration facilities is provided in a report recently issued by the Technology Assessment Division of the Department of Natural Resources: "Louisiana Electric Generation and Distribution Utilities."

LOUISIANA, AN ENERGY CONSUMING STATE: AN UPDATE USING 2001 DATA

by Brian Crouch, P.E.

In 2001, Louisiana ranked 8th among the states in total energy consumption with 3499.5 trillion BTUs (TBTUs). Figure 1 breaks down the total energy consumption into percentages attributable to each sector.

The largest energy consumer, by far, is the industrial sector. Louisiana's abundant natural resources have historically meant low energy prices which have attracted energy intensive industries to Louisiana such as chemical, petrochemical, and refining. Louisiana ranks 2nd in the nation, behind Texas, in industrial energy consumption.

Louisiana is also a large consumer of transportation energy, much of which is attributable to the transportation of oil and gas. Louisiana ranks 11th in the nation in transportation energy usage.

Figure 1

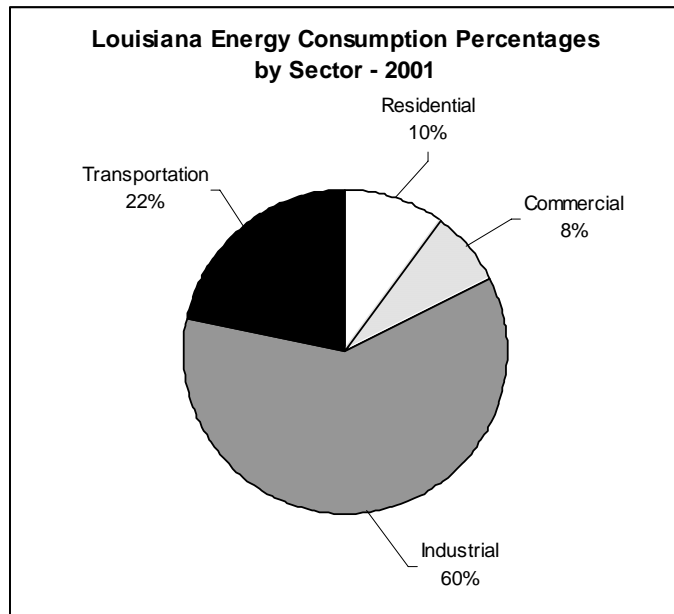


Table 1 shows where Louisiana ranks among the states in various energy consumption categories and lists the top energy consuming state for each category.

Table 1

Louisiana's high natural gas ranking reflects the large usage of natural gas as both a heat source and feed stock for several Louisiana industries.

Louisiana's high per capita energy consumption is skewed due to the large industrial and transportation energy consumption and relatively low population.

Louisiana also produces huge quantities of energy. Table 2 compares Louisiana's energy consumption to its energy production. It shows that in 2001, Louisiana consumed 976 more TBTUs of energy than it produced if Louisiana OCS oil and gas production is not included.

Louisiana Energy Consumption Rankings Among the States			
Category	Rank	TBTU	#1 State (TBTU)
Residential	22	347.8	Texas (1569.9)
Commercial	23	263.5	California (1508.8)
Industrial	2	2134.8	Texas (6426.3)
Transportation	11	753.4	California (2971.0)
Coal	31	240.0	Indiana (1567.1)
Natural Gas	3	1339.5	Texas (4434.6)
Petroleum	5	1491.4	Texas (5521.0)
Electricity	18	254.8	Texas (1078.4)
Total	8	3499.5	Texas (12028.8)
Per Capita (MBTU)	3	783.6	Alaska (1164.3)

OVERVIEW OF LOUISIANA ELECTRIC GENERATION, INDEPENDENT POWER PRODUCERS AND COGENERATORS¹

by Patricia Nussbaum, Engineer

Louisiana investor owned utilities (CLECO, SWEPCO, Entergy Gulf States, Entergy Louisiana, and Entergy New Orleans) dominate the Louisiana marketplace with nearly 75% of the customers, 85% of power sales and 55% of the electric generation capacity.

There are 22 cities in Louisiana that own their own independent municipal power distribution systems. The Louisiana Energy and Power Authority (LEPA), created in 1979, is a political subdivision of the State of Louisiana. LEPA is a non-profit, joint-action agency working to provide its member communities with firm, stable sources of electricity at the lowest possible cost. Eighteen Louisiana municipalities are currently LEPA members.

Independent power producers (IPPs) and cogenerators also provide power generation capacity. IPPs produce electricity for sale to the public. Cogenerators produce electric power, are connected to the grid and can sell power to the public. Industrial firms cogenerate power both for internal process plant use and for the sale of excess power into the market. Louisiana has total net power generation of approximately 95 million megawatthours (mwhrs). Electric Utilities generate about 55 million mwhrs, IPPs generate 17 million mwhrs and 23 million mwhrs comes from cogeneration (combined heat and power).

Fifty percent of Louisiana's electric power generation relies on natural gas as its fuel source. Twenty-three percent of power generation is coal fired, 18% comes from nuclear power and 9% comes from petroleum, hydroelectric, renewables and other.

Table 1
LOUISIANA 2002 NET GENERATION BY TYPE OF PRODUCER AND ENERGY SOURCE

Type Of Producer	Energy Source	Generation (mwhrs)	Percent
Total Electric Generation in the State	Coal	22,050,906	23%
	Petroleum	1,864,536	2%
	Natural Gas	47,900,848	50%
	Other Gases	1,497,624	2%
	Nuclear	17,305,328	18%
	Hydroelectric	891,441	1%
	Other Renewables	2,862,791	3%
	Other	597,490	1%
Total		94,970,964	100%
Electric Generators, Electric Utilities	Coal	12,258,694	22%
	Petroleum	68,460	<1%
	Natural Gas	25,085,994	46%
	Other Gases	203,484	<1%
	Nuclear	17,305,328	32%
	Hydroelectric	0	0
	Other Renewables	0	0
	Other	0	0
Total		54,921,960	100%

Table 1 (cont)

LOUISIANA 2002 NET GENERATION BY TYPE OF PRODUCER AND ENERGY SOURCE (cont.)

Type Of Producer	Energy Source	Generation (mwhrs)	Percent
Electric Generators, Independent Power Producers	Coal	9,766,681	58%
	Petroleum	118,581	<1%
	Natural Gas	6,105,344	36%
	Other Gases	0	0
	Nuclear	0	0
	Hydroelectric	891,441	5%
	Other Renewables	59,087	<1%
	Other	0	0
	Total	16,941,134	100%
Combined Heat and Power, Indep. Power Producers	Coal	0	0
	Petroleum	1,646,229	100%
	Natural Gas	3,683	<1%
	Other Gases	0	0
	Nuclear	0	0
	Hydroelectric	0	0
	Other Renewables	0	0
	Other	0	0
	Total	1,649,912	100%
Combined Heat and Power, Commercial Cogenerator	Coal	0	0
	Petroleum	0	0
	Natural Gas	32,000	100%
	Other Gases	0	0
	Nuclear	0	0
	Hydroelectric	0	0
	Other Renewables	0	0
	Other	0	0
	Total	32,000	100%
Combined Heat and Power, Industrial Cogenerator	Coal	25,531	<1%
	Petroleum	31,266	<1%
	Natural Gas	16,673,826	78%
	Other Gases	1,294,140	6%
	Nuclear	0	0
	Hydroelectric	0	0
	Other Renewables	2,803,704	13%
	Other	597,490	3%
	Total	21,425,957	100%

¹ Sprehe, Bob (2005). Louisiana Electric Generation and Distribution Utilities.

Louisiana has approximately 2.1 million consumers of electricity. Fifteen thousand are industrial customers, 200,000 are commercial customers and the remaining customers are residential. This generates \$4,746,400 (revenue in thousand dollars).

Availability of electricity is critical for Louisiana's economic growth. Recently, however, the volatility of natural gas prices has driven up the price of electricity. With so much electric power generation in Louisiana and nationally dependent on the natural gas supply, the dependability of electric power generation becomes a public policy issue.

The age of the infrastructure is also an area of concern in Louisiana. The majority of the generation

capacity of the IPPs and the cogenerators has come on line in the past 10 years, but nearly 80% of the investor owned capacity and 95% of the publicly owned capacity is over 20 years old. This update tabulates the electric utilities and cogeneration facilities available in the state as of 2002. Data is secured from the Energy Information Administration.

Table 2
EXISTING ELECTRIC GENERATING UNITS IN LOUISIANA IN 2002

<u>Company/Type of Producer</u>	<u>Prime Mover/Installed Capacity (Megawatts)</u>	<u>Energy Source</u>
Agrilectric Power Partners LTD/IPP	Steam Turbine/ 13.6	Ag.Crop Byproducts
Air Products and Chem/Ind. Cogen.	Steam Turbine, Combustion (Gas) Turbine/ 31.2	Natural Gas
Alexandria, City of/ Elec. Util.	Steam Turbine/ 175	Natural Gas
BASF Corp/Ind. Cogen.	Combustion (Gas) Turbine/ 76.9	Natural Gas
Bayou Cove Peaking Power LLC/ IPP	Combustion (Gas) Turbine/ 440	Natural Gas
Big Cajun I Peakers/IPP	Combustion (Gas) Turbine/ 256	Natural Gas
Boise Cascade Corp/Ind. Cogen.	Steam Turbine/ 61.5	Black Liquor
Borden Chemicals and Plastics/Ind Cogen	Combustion (Gas) Turbine/ 103.6	Natural Gas
BP America Production Co/ Ind. Cogen.	Steam Turbine/ 1.8	Natural Gas
Calcasieu Power LLC/IPP	Combustion (Gas) Turbine/ 320	Natural Gas
Calpine Corp/IPP	Combined Cycle Combustion, Steam Turbine, Combined Cycle/ 1220	Natural Gas
Chevron Oronite Co LLC/Ind/Cogen.	Combustion (Gas) Turbine/ 25	Natural Gas
CII Carbon LLC/IPP	Steam Turbine/ 46	Petroleum Coke
CITGO Petroleum Corp/Ind. Cogen.	Steam Turbine/ 75	Other Gas
Cleco Evangeline LLC/IPP	Combined Cycle Combustion, Combined Cycle/ 922.8	Natural Gas
CLECO Power LLC/Elec. Util.	Steam Turbine, Combustion (Gas) Turbine/ 2162	Lignite Coal, Natural Gas, Sub-bituminous Coal
Colonial Sugar Refinery/Ind. Cogen.	Steam Turbine/ 7.4	Natural Gas
Dow Chemical Co/Ind. Cogen.	Combined Cycle Single Shaft, Combined Cycle, Combined Cycle Combustion/ 788	Natural Gas, Waste Heat
Dow Chemical – St Charles/Ind. Cogen.	Combined Cycle Single Shaft, Combined Cycle, Combined Cycle Combustion/ 273.6	Natural Gas, Waste Heat
DSM Copolymer/Ind. Cogen.	Steam Turbine/ 6	Natural Gas
Dynegy Midstream Services/IPP Cogen.	Combustion (Gas) Turbine/ 2.5	Natural Gas
Entergy Gulf States Inc./Elec. Util.	Steam Turbine, Combustion (Gas) Turbine/ 5235.2	Natural Gas, Sub-bituminous Coal, Nuclear
Entergy Louisiana Inc/ Elec. Util.	Steam Turbine, Combustion (Gas) Turbine, Combined Cycle Combustion, Combined Cycle/ 6310	Natural Gas, Nuclear
Entergy New Orleans Inc./Elec. Util.	Steam Turbine, Combustion (Gas) Turbine/ 1108.1	Natural Gas, Distillate Fuel Oil
Exxon Mobil/ Ind. Cogen.	Combustion (Gas) Turbine/ 507.4	Natural Gas
Exxon Mobil Production Co./Ind. Cogen.	Internal Combustion Engine, Steam Turbine, Combustion (Gas) Turbine/ 147	Natural Gas
First National Bank – Commerce/IPP	Hydraulic Turbine/ 192	Water
Formosa Plastics Corp/Ind. Cogen.	Steam Turbine, Combustion (Gas) Turbine/ 143.7	Natural Gas
Gayland Container Corp/Ind. Cogen.	Steam Turbine/ 99.5	Natural Gas
Georgia Gulf Corp./Ind. Cogen.	Combustion (Gas) Turbine/ 306	Natural Gas
Georgia-Pacific Corp/Ind. Cogen.	Steam Turbine/ 60	Black Liquor

Table 2 EXISTING ELECTRIC GENERATING UNITS IN LOUISIANA IN 2002 (cont.)

<u>Company/Type of Producer</u>	<u>Prime Mover/Installed Capacity(Megawatts)</u>	<u>Energy Source</u>
IMC Phosphates Co./Ind. Cogen.	Steam Turbine/ 22 mw	Other
International Paper Co/Ind. Cogen.	Steam Turbine/ 59.3 mw	Natural Gas
IPC Mansfield Mill/Ind. Cogen.	Combustion (Gas) Turbine, Steam Turbine/ 135 mw	Natural Gas, Wood/Wood Waste Solids
IPC – Pine/Ind. Cogen.	Steam Turbine/ 25 mw	Natural Gas
Jeanerette Sugar Co. Inc./Ind. Cogen.	Steam Turbine/ 2.5 mw	Agricultural Crop Byproducts
Kaiser Aluminum/Ind. Cogen.	Combustion (Gas) Turbine, Steam Turbine/ 117.3 mw	Natural Gas
Lafayette, City of/ Elec. Util.	Steam Turbine/ 379.6 mw	Natural Gas
Louisiana Energy & Power Authority (LEPA)/Elec. Util.	Internal Combustion Engine/ 9.4 mw	Distillate Fuel Oil
Louisiana Generating LLC/IPP, IPP Cogen	Steam Turbine/ 2170.2 mw	Natural Gas, Sub-bituminous Coal
Louisiana Tech Univ./Commercial	Steam Turbine/ 7.5 mw	Natural Gas
Lyondell Chemical Co/Ind. Cogen.	Steam Turbine/ 4.3 mw	Natural Gas
M A Patout & Sons Ltd/Ind. Cogen.	Steam Turbine/ 3 mw	Agricultural Crop Byproducts
Minden, City of/Elec. Util.	Steam Turbine, Internal Combustion Engine/ 35.3 mw	Natural Gas
Mobil Oil Corp – Chalmette/Ind. Cogen.	Other/5.7 mw	Other
Morgan City, City of/Elec. Util.	Steam Turbine/ 70.3 mw	Natural Gas
Natchitoches, City of/Elec. Util.	Internal Combustion Engine, Steam Turbine/ 53 mw	Natural Gas
Nelson Industrial Steam Co./IPP Cogen.	Steam Turbine/ 280.2 mw	Petroleum Coke
NRG South Central Generating/IPP	Combustion (Gas) Turbine/ 216 mw	Natural Gas
Ouachita Operating Services LLC/IPP	Combined Cycle Combustion, Combined Cycle/ 1018.5 mw	Natural Gas
PCS Nitrogen LP/Ind. Cogen.	Combustion (Gas) Turbine/ 26 mw	Natural Gas
Perryville Energy Partners/IPP	Combined Cycle Combustion, Combined Cycle/ 533.2 mw	Natural Gas, Waste Heat
Placid Refining Co. LLC/Ind. Cogen.	Combustion (Gas) Turbine/ 7.6 mw	Natural Gas
Plaquemine, City of/Elec. Util.	Steam Turbine/ 44 mw	Natural Gas
PPG Industries Inc/Ind. Cogen.	Combined Cycle Single Shaft, Combined Cycle, Combined Cycle Combustion/ 576 mw	Natural Gas, Waste Heat
Rayne, City of/Elec. Util.	Internal Combustion Engine/ 8.2 mw	Natural Gas
Reliant Energy Field Services/Ind. Cogen.	Internal Combustion Engine/ 1.2 mw	Natural Gas
Riverwood International Corp./Ind. Cogen.	Steam Turbine/ 63 mw	Natural Gas
Ruston, City of/Elec. Util.	Steam Turbine/ 80.9 mw	Natural Gas
Southwestern Electric Power Co./Elec. Util.	Steam Turbine/ 403 mw	Natural Gas
Stone Container Corp./Ind. Cogen.	Steam Turbine/ 74.4 mw	Natural Gas
Taft Cogeneration LP/Ind. Cogen.	Combined Cycle Combustion, Combined Cycle/ 835 mw	Natural Gas
TEMBEC/Ind. Cogen.	Combustion (Gas) Turbine, Steam Turbine/ 57.5 mw	Natural Gas, Black Liquor
Terrebonne Parish Consolidated Gov't/ Elec. Util.	Internal Combustion, Steam Turbine/ 99.3 mw	Natural Gas
The American Sugar Refining Co./Ind. Cogen.	Steam Turbine/9 mw	Natural Gas
TOSCO Refining Co./Ind. Cogen.	Other, Steam Turbine/ 25 mw	Other Gas
Vulcan Materials Co/Ind. Cogen.	Combined Cycle Combustion, Combined Cycle/ 113 mw	Natural Gas
Western Gas Resources Inc/Ind. Cogen.	Internal Combustion Engine/ 2.8 mw	Natural Gas

Source: U. S. Department of Energy, Energy Information Administration 2002 Data.

THE QUIET BOOM!

by

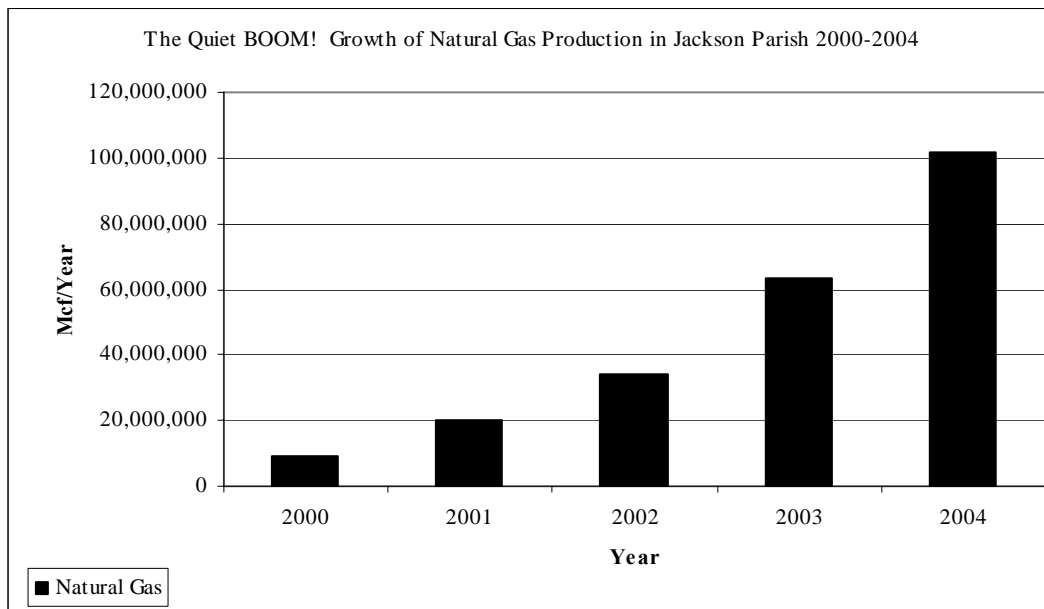
Bob Sprehe, Energy Economist, Technology Assessment Division
Dave Elfert, Geologist, Office of Conservation
Alan Boyd, Biologist, Weyerhaeuser Company
Eric Baka, Department of Wildlife and Fisheries

In the oil and natural gas industry, there are very few things that are quiet, especially new discoveries and subsequent drilling booms. Jackson Parish, La. is the exception.

In a very quiet manner, led by Anadarko Petroleum Corp., a revolution in deep drilling in North Louisiana (15,000 ft. +/-) has been underway since 2001. Through April 2005, Anadarko has drilled and completed 258 of these deep (15,000 ft. +/-) high pressure, high temperature Lower Cotton Valley natural gas wells. According to records available in the Office of Conservation, Anadarko invested nearly \$201,600,000 in just 55 wells, an average of \$3.7 million per well.

The result for the Jackson Parish Police Jury and Parish Administration and the State of Louisiana Department of Natural Resources is another successful model program of how state agencies and the private oil and gas sector can cooperate in commercial exploitation of deep energy reserves while sustaining responsible environmental practices in sensitive surface areas, including wetlands, and preserving the habitat of an endangered species, the red cockaded woodpecker. This is a regulatory economic model all political bodies should learn from and seek to emulate.

Figure 1
Jackson Parish Natural Gas Production Is Growing Exponentially



North Louisiana -- of which Jackson Parish and the Vernon Field specifically are the dominant geologic features at this time -- accounted for more than 20 percent of the nation's natural gas reserves added between 2001 and 2003, according to data published by the Energy Information Administration.

This is a very significant contribution to the nation's natural gas deliverability base at a time when political leaders are questioning the reliability of the domestic natural gas supply.

Jackson Parish Natural Gas Reserves are a significant portion of the Nation's Deliverability Base

Table 1

Jackson Parish Dry Natural Gas Proved Reserves, and Reserve Growth, Tcf^{1/} - 2001-2003

<u>Year</u>	<u>U. S.</u>		<u>North LA</u>	<u>%</u>
2003	189,044		5,074	2.68%
2001	183,460		3,881	2.12%
Increase	5,584		1,193	21.36%

Source: Energy Information Administration
U. S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves,
2003 Annual Report

^{1/}Tcf = Trillion cubic Feet

Geology

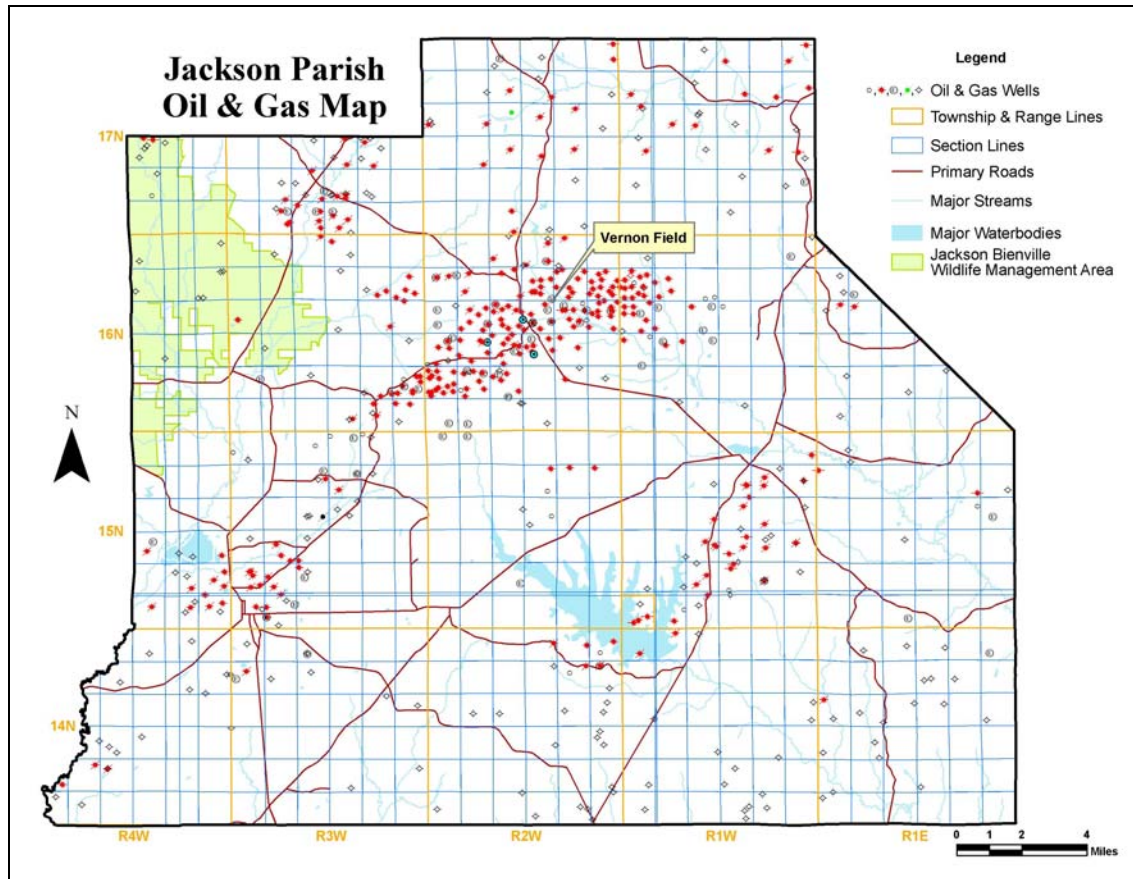
Industry has recognized the potential for natural gas exploitation in the Vernon Field area since the early 1980s. More precise seismic interpretation, combined with successful experience in large, water-based fracturing techniques in East Texas and Oklahoma, have made commercialization of these deep (15,000 feet +/- total vertical depth [TVD]) Lower Cotton Valley sands viable at this time.

The two most active and prolific areas of the Vernon Field are the northern fault block, located approximately in Township 16 North, Range 2 West, (T16N, R2W) sections 9-12, and the southern fault block, located in T16N, R2W sections 28-30. Both of these areas are structural traps in the Lower Cotton Valley. Other areas of the Vernon Field also hold potential and will be exploited in the future.

There are lesser accumulations of natural gas reserves in the Upper Cotton Valley and the Hosston formations. The geologic age of the Hosston is Lower Cretaceous, while the Cotton Valley is Jurassic in geologic age.

While 258 wells have been completed through April 2005, Anadarko has not yet defined the limits of the potential producing zones. General Manager for the Eastern Gulf Coast Operations, Bob Stancil, suggests that as many as 400 wells may be drilled. Currently, Anadarko has nine rigs drilling. [Insert 2 pages, cross section and oil and gas surface map] Sand thicknesses in the producing wells run between 1,500 and 3,000 feet. Currently this thickness allows for 40-acre well spacing. Future experience with reservoir drainage patterns may allow well spacing to drop to 20 acres

Figure 2



Oil and Gas Map of Jackson parish

Well Construction Plans

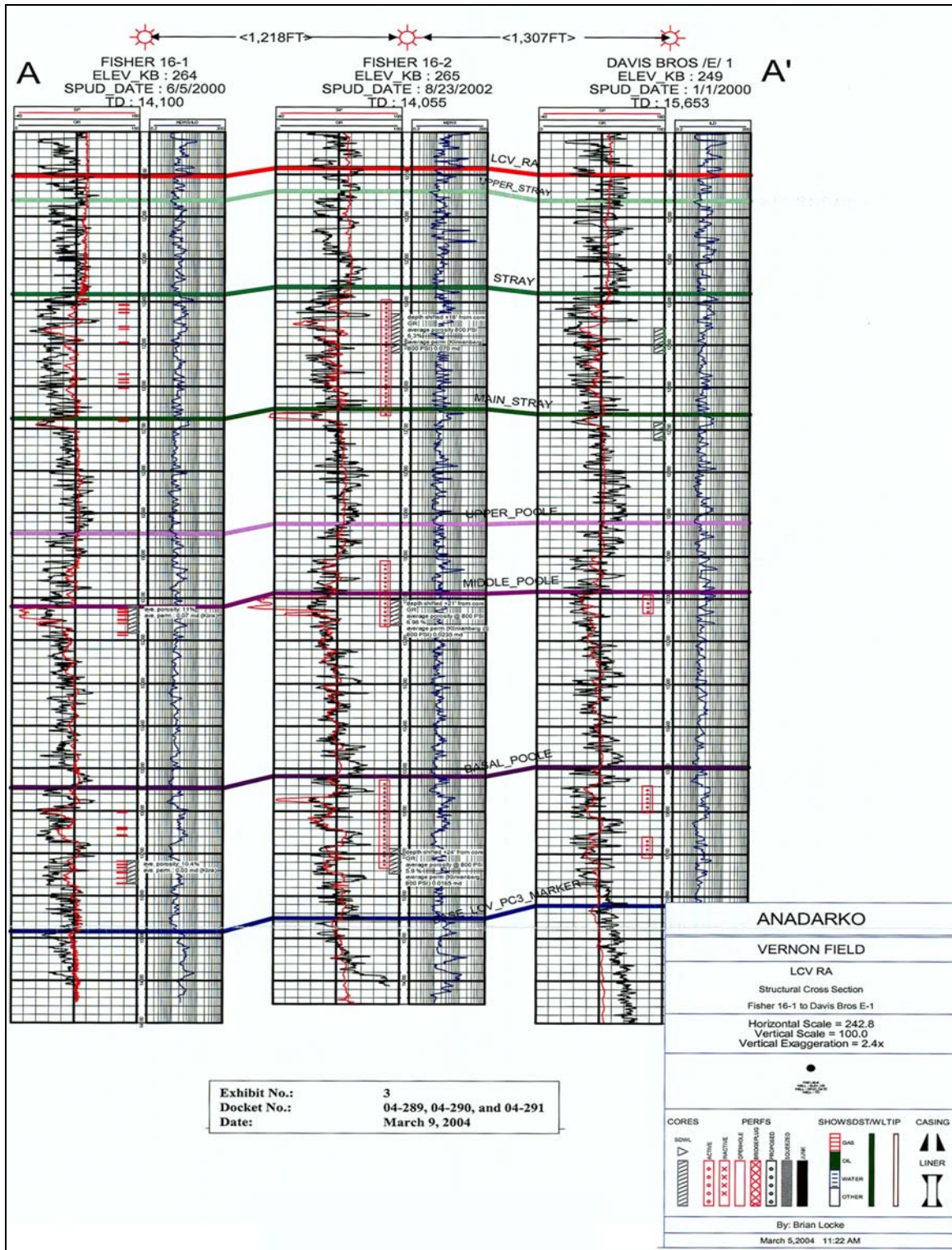
Besides conductor pipe driven to begin the drilling process, Anadarko sets three strings of casing: surface pipe to cover the fresh water bearing horizons, a protective casing string into the pressure transition zone below the Knowles lime and a production string to total depth (TD).

The Lower Cotton Valley (LCV) is geo-pressured, meaning that formation pressures exceed a normal salt water gradient. High mud weights are required to drill into the LCV pay zone.

The wells are perforated at multiple levels across the Lower Cotton Valley pay interval. Several frac jobs of fresh water and sand, followed by a flush of fresh water to push the sand propping agent back into the formation, are run through the perforated intervals, and production flow is commingled.

So far, Anadarko has not located a free water level in the Lower Cotton Valley. Initial flow rates range from three to 15 million cubic feet per day (MMcf/day). The wells, subsequently, exhibit a hyperbolic decline curve over the long life expectancy of reservoir production.

Figure 3



Cross Section of LCV from Anadarko filing with Office of Conservation

Figure 4



Drilling Rig at Work in Anadarko's Vernon Field,
Jackson Parish, Louisiana

Wetlands, Woodpeckers, and Water

There is a long history of sustainable environmental development harmony between Louisiana's legislature, state regulatory agencies, parish governments, and oil and gas extraction industries.

Jackson Parish is a recent example of just that harmony. There are wetlands in the Vernon Field. The endangered red-cockaded woodpecker makes its habitat among the woodlands in the Vernon Field, and rig water supply is drawn from the Sparta Aquifer which is present at very shallow depths (approximately 500 ft. subsea +/-) in the Vernon Field.

Anadarko complies fully with the wetlands permit requirements and restoration. The endangered species habitat is avoided, and rig water supply wells are plugged and abandoned (P&A) as required by State law when no longer needed.

The harmony of subsurface development of scarce natural gas resources, while respectfully using and preserving valuable environmental assets, is a Louisiana model for all political bodies around the globe to emulate.

Weyerhaeuser Company, a major forest landowner within the Vernon Field, can attest to the environmentally responsible approach taken by Anadarko. When Anadarko first began operations in the Vernon Field, they were informed of Weyerhaeuser's detailed environmental expectations with respect to road, pipeline, and well site construction – especially when in proximity to streams, other wetlands, and special sites such as nesting and forage habitat for the red-cockaded woodpecker.

A systematic process of communication has resulted to ensure that all aspects of environmental concerns are addressed. Once Weyerhaeuser receives a request from Anadarko to review proposed activity, the information is distributed to the appropriate Weyerhaeuser managers, foresters, researchers, and environmental personnel for their review and recommendations. These comments are then accumulated and forwarded to Anadarko for their consideration.

Weyerhaeuser managers say Anadarko's reception of this feedback and their resulting environmental performance has been nothing less than impressive, not only meeting, but exceeding Weyerhaeuser's expectations. Much detailed and costly effort by Anadarko has gone into executing this process to meet their goals while also protecting the long-term sustainability of Weyerhaeuser's land, water, and wildlife resources.

Some specific examples demonstrating Anadarko's desire to incorporate ecologically-friendly practices include their considerations for wildlife when conducting operations within the Jackson-Bienville Wildlife Management Area. Anadarko is working with Louisiana Department of Wildlife and Fisheries (LDWF) biologists to consider planting special wildlife seed mixes along pipelines and road rights-of-way and adjusting mowing schedules to accommodate turkey nesting. Also, when possible, Anadarko is minimizing their "footprint" and avoiding environmentally sensitive areas in the WMA by drilling multiple wells on a single pad and by using directional drilling technology. These efforts are a formula that adds up to enhanced wildlife habitat and retention of biological diversity.

Economic Payoff

With 258 wells completed as of the end of April, 2005, and an average investment of \$3.7 MM/well, Anadarko has close to a \$1 billion dollar investment in Jackson Parish to this point in time.

Additionally, Anadarko has built an office facility and a natural gas liquids stripping plant. Others have invested in new pipeline capacity to transport the natural gas production from the field to nearby interstate natural gas pipelines and on to the Midwest and East Coast population centers.

Even at this early stage of economic evolution, three other factors illustrate the economic impact in Jackson Parish of this harmonious coexistence of oil and gas extraction and environmental preservation: ad valorem assessments, Louisiana adjusted income tax, and sales taxes collected.

Figure 5

Ad valorem assessments on Wells have increased over \$12,000,000 between 2000 and 2004.

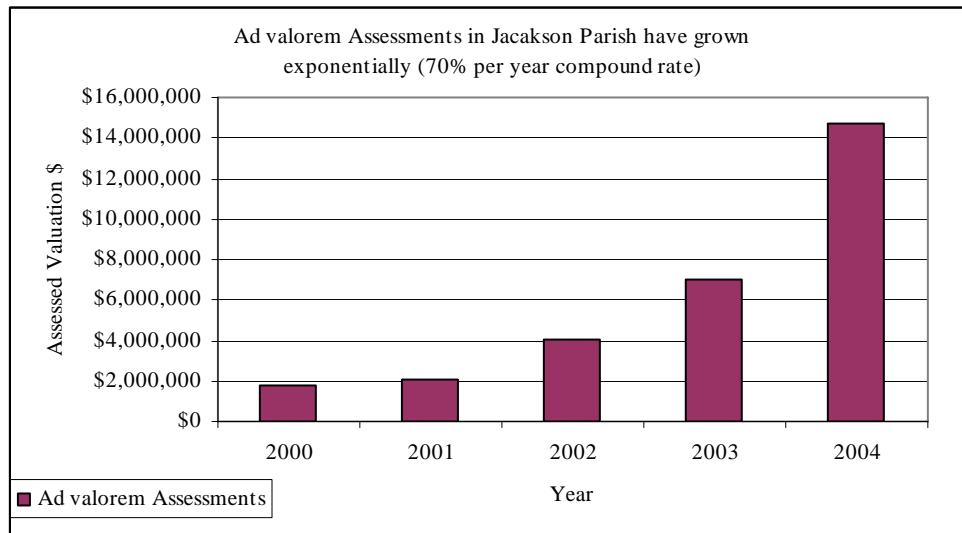


Figure 6

Louisiana Adjusted Income Tax from Jackson Parish has increased at a 5% per Year Rate

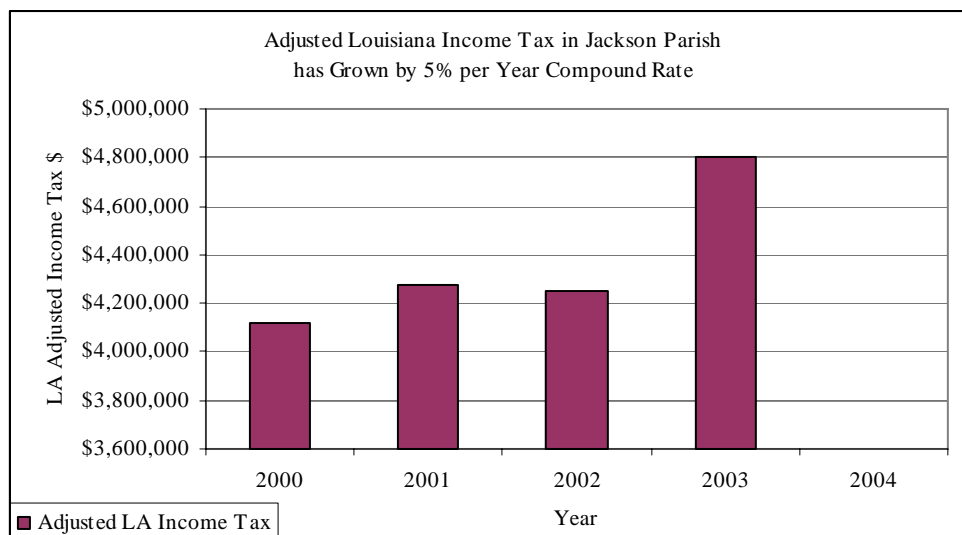
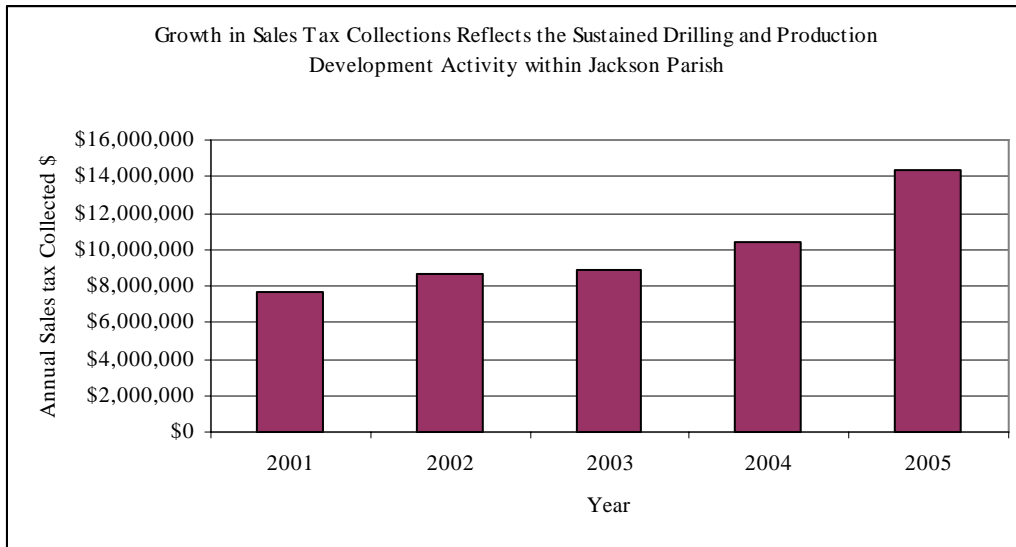


Figure 7

Sales taxes collected in Jackson Parish have increased by 75% from 2000 to 2004;



“...Win, Win, Win, Win...”

In the Real Estate world, value is characterized as “...location, location, location...”

With the kind of valuable cooperation and knowledge present in the state administration, legislature, regulatory agencies, the private sector, oil and gas companies and landowners, Anadarko **wins**, Jackson Parish **wins**, Louisiana’s residents **win and** the landowners **win**. And, the nation’s consumers **win** with increased natural gas supply and a corresponding slowing of natural gas price increases that otherwise would not have been available.